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Continuity of Supply.

WHILE low costs of production are essential for the offering of rates low enough to secure profitable loads, it is by the reliability of electricity supply that the consumer will ultimately judge the feasibility of relying solely upon it for his everyday needs, whether in industry or in the home. It may certainly be said that electrical apparatus generally is far more reliable than it has ever been, but, on the other hand, many of its modern applications require far greater security from interruption than was essential in the past. Moreover, the larger scale of working occasioned by the increased loads has introduced entirely new factors which make the securing of freedom from interruption of supply a much less simple matter than it was before high-voltage interconnected networks became established practice.

We, in Great Britain, have prided ourselves upon the high standard of reliability maintained by our supply systems. It is only fitting, therefore, that this country should hold a paramount position in the design of protective gear, since the fundamental duty of such apparatus is the protection of the system, and only secondarily that of saving apparatus from damage. It is inevitable that even the most normally constructed apparatus should be liable to failure, and the provision of alternative sources of supply will fail of their purpose unless there is adequate discrimination against the faulty section. For some 25 years such discrimination has been obtained in the majority of cases through the operation of the principle that the currents flowing into and out of a healthy feeder or transformer are equal. Although this might seem only to involve a direct application of Kirchoff's law, its satisfactory adaptation to practical conditions has involved enough difficulty to give scope to considerable ingenuity. The chief objection to the method is an economic one—the high cost of the pilot wires required. Modern conditions, necessitating transmission over longer distances by overhead lines, emphasise the disproportionate cost of protection by this means, and it is no exaggeration to say that among the most urgent technical problems of to-day is the design of an inexpensive substitute for the Merz-Price system and its subsequent modifications which will give equal reliability in discrimination.

The paper read last week before the Institution by Messrs. T. W. Ross and H. G. Bell, while not exhausting the possibilities of the subject, certainly set out very clearly the problems to be faced, and contained a definite contribution towards a solution of the problem. We hope it will be a precursor of other Institution papers on protective gear.

The Needs of Industry.

EACH day sees a new contribution, or a re-statement of previous contributions, to the discussion upon the position of British industry and possible remedies for the state in which it has languished so long. Last week there were two notable addresses on the subject both of which are reported elsewhere in this issue.

The first was by Mr. D. A. Bremner, Director of the British Engineers' Association, at a luncheon of that body, who pointed out that it was possible to produce any amount of goods; the problem was to find a market for them. It was no longer possible for British manufacturers to " muddle through " their difficulties; they had to organise and equip themselves to meet highly-trained foreign competitors. He drew attention to the strange position of this country with regard to Customs duties. Although we collected more revenue in this way than any other country our tariff only afforded protection to 6 per cent. of our industries. So far as we were concerned, the proposed " tariff truce " was an absurdity. His remedy was a readjustment of the traditional British attitude towards import duties to meet the altered conditions. He urged industrialists to organise more efficiently so as to become a real power in the government of the country.

The other pronouncement upon industrial affairs was made by Sir Josiah Stamp, who dealt with a subject to which Mr. Bremner made no reference. Although the title of the address was " The Present Position of Rationalisation," the bulk of it was an *exposé* of what rationalisation was not, and of a number of things which militated against its realisation. As we have stated before, rationalisation is not mere trustification to maintain prices at a high level, nor is it purely restriction of output with a similar aim. It endeavours to secure the highest efficiency throughout an industry by the elimination of concerns which cannot produce at a reasonable cost. It is the reluctance on the part of these concerns to be " eliminated " which appears to be the chief bar to schemes of rationalisation. They seem to be uncertain whether they are to be squeezed out or bought out. The latter course is not likely to be financially sound, and if the former is adopted the hesitancy of the inefficient ones is understandable.

The Powers of the Electricity Commissioners.

A CORRESPONDENT has drawn our attention to the high charges and unreliability of supply in a small town and expresses disappointment with the Electricity Commission. Without expressing any views as to the causes of the complaint of our correspondent or as to the commercial policy which charges high rates for uses other than lighting—and only those who have operated an undertaking with a 100-kW d.c. generating station can fully realise the obstacles in the way of giving a cheap and reliable supply—it may serve a useful purpose if we set out briefly some of the powers of the Commissioners in a case like this.

Rightly or wrongly, Parliament has allowed very little power to the Commission to initiate action for " promoting, regulating, and supervising the supply of electricity "—the purpose for which it was set up. Apart from the compilation of statistical records—in itself a work of considerable importance to the industry—the duties of the Commission are largely negative; thus it may veto the erection of a new or the extension of an old generating station or main transmission line, if a supply can be obtained on as favourable terms from another source. The initiative for improvement in supply must come from elsewhere.

In regard to fluctuations in voltage and other breaches of regulations, any consumer has the right to apply to the local authority (where the latter is not the undertaker), or, failing action on its part, to the Electricity Commission, to appoint an " electrical inspector " to carry out appropriate tests.

Whether the result of such an action would benefit the consumer is at least doubtful owing to the Draconian character of the law on this point, since the only penalty recognised for failure on the part of the undertaker to rectify the position is, we believe, revocation of the Order. Possibly some undertakings would not greatly object to being relieved of their obligations in this way; in fact, provision is made in the Acts for such an end to unsuccessful commercial ventures.

In regard to prices—and here again it should be remembered that what seems an unreasonably high rate in a small area may yield a return far less than would perhaps one-third of the rate in an industrial community—it is open to 20 or more consumers to make application to the Minister of Transport to hold an inquiry into the matter. One such inquiry was held recently and resulted in a slight reduction in price.

In small towns and villages, out of range of larger transmission systems, we fear that until the Central Electricity Board is able to supersede the local generating station by a bulk supply there is little hope of a substantial improvement in the position. Here again it must be remembered that the function of the Central Electricity Board is not to provide cheap electricity to the individual consumer, but only to make it possible in many cases for the local undertaking to do so. Even then the cost of small-scale distribution must be heavy, but the position will be eased by the fact that the running charge will be greatly reduced, enabling reasonable prices to be charged for long-hour consumers —a factor which should react favourably on the price for lighting. We suggest that consumers so situated may, nevertheless, take some comfort, for the present, in reflecting on the difference between electricity even at a high price and those alternatives which are all that many similarly placed districts are able to obtain.

The Retention of British Control.

DURING the last two or three years a number of British companies have taken steps to restrict the holding of their capital by foreigners, the General Electric Co., Ltd., being the outstanding example in the electrical industry. Last week the directors of the Calcutta Electric Supply Corporation, Ltd., introduced a similar scheme to their shareholders, and although there was some opposition their proposals are to become effective, and no more than 20 per cent. of the company's capital will be allowed to fall into non-British hands. The Calcutta case is different from its forerunners in that it was principally due to pressure brought to bear by the Bengal Government; in the other instances the movement has commenced within the companies themselves.

Opposition to the proposals was based mainly on their probable effects upon British capital invested in foreign concerns, but, so far as we are aware, earlier developments of this nature have not caused any serious reaction against British investors abroad.

To our mind the proponents of the scheme had a far stronger case, *i.e.*, the absolute necessity of ensuring that the company's future plant requirements will be supplied by British industry. Surely it is better to risk the problematical anger of foreigners than the practical certainty of losing much-needed work for this country.

The Passing of Dr. de Ferranti.

THE news of the death of Dr. S. Z. de Ferranti (recorded in our " Personal " column to-day) will come as a shock to electrical engineers throughout the world.

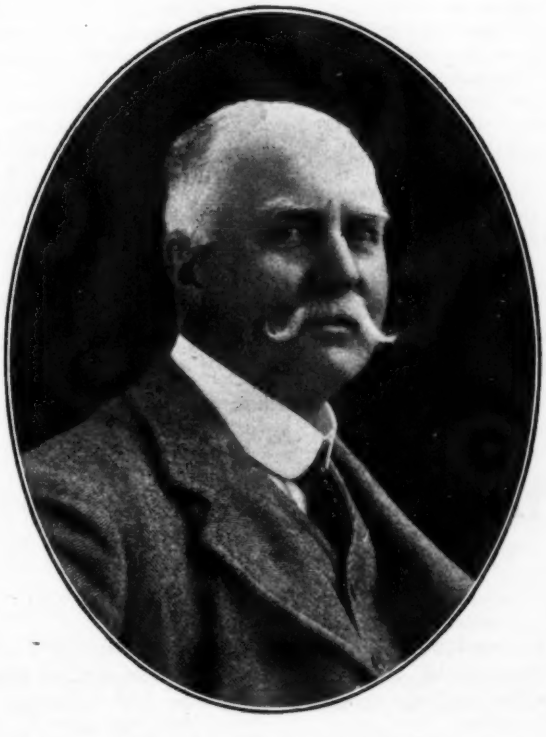
It is impossible to attempt this week an appreciation of the life and work of Dr. de Ferranti, and his unequalled position in the electrical world, and we therefore propose to defer our more considered tribute until a subsequent issue.

Henry Alabaster.

FAR from easy to fulfil is the sad duty that falls to us to write of the death of Henry Alabaster, who passed away on Monday, January 13th, in his eighty-fourth year.

Memory glancing backward over nearly forty years' close and practically unbroken association recalls so much of interest that could be told, that concentration becomes imperative on only a few outstanding points. Without any exaggeration it can be said that Mr. Alabaster occupied a unique position in relation to the electrical profession and industry, from the date of his acquisition, in 1874, of the then few-paged pamphlet (now known everywhere as the ELECTRICAL REVIEW), until his death.

Mr. Alabaster was born in the north of London in August, 1846. He married in 1886 Helen Elizabeth Hawkes, granddaughter of the late John Hawkes, Esq., of Milan Hall, Co. Cork. Not being one of the most robust, he, as a young man, fought a battle with ill-health with a dogged determination which became one of the marked characteristics of his subsequent career. London, his birthplace, claimed him henceforth for various pursuits. First, he engaged in the exercise of artistic talents and interests, studying under the late Sir E. J. Poynter at University College, London, where he obtained in 1871 the First Silver Medal for the best painting from life. Then followed the control and management of the small paper in which he became interested in the year already named, showing considerable foresight, and as opportunity offered bringing his own business acumen, with the co-operation of his subsequent partners, to bear upon the laying of the foundation of what was to become one of the leading technical and trade papers of the world.



The Late Mr. Henry Alabaster.

In pre-association days Mr. Alabaster's counsel was often sought, in conjunction with that of his partner Mr. T. E. Gatehouse, by professional men, manufacturers, and traders, and the guidance given was highly appreciated by men who found themselves in difficult places, or facing serious problems, and by others who sought the support of the journal in new movements. This was so because of the independent attitude, complete impartiality, and general desire to assist, which characterised the editorial policy of the REVIEW—the fruit of the independence of thought that controlled its proprietors and editors. One recalls gatherings of many groups of scientists, electrical engineers, manufacturers and others in the REVIEW rooms, in which Henry Alabaster, T. E. Gatehouse, and sometimes Mr. H. R. Kempe, were central figures. Then, as with their successors, expert criticism and constructive suggestion were always freely at command.

At times it fell that some fraud or nostrum, some injustice or some over-weening ambition or unworthy self-seeking, which called for tactful handling, required a strong editorial line to be adopted, with risks of litigation among the possibilities. It was at such times that both caution and strength were essential, and with this combination assured the REVIEW championed a number of important causes. In saying this we are describing an aspect of Mr. Alabaster's character which no faithful account of his career can overlook. He and Mr. Gatehouse together made a strong combination, and small wonder is it that those who daily sat with them became schooled in their traditions. If Mr. Gatehouse was the "attacker," Mr. Alabaster drew at times on his reserves of strong moral backing. He will be remembered in business affairs as a man of few words, and those words generally either discreet, or directly to the point. His look conveyed more than his speech. Only once did misfeasance lead him to "take measures," but many instances could be quoted of a human tenderness exercised toward employés—a tubercular youth sent to the moors in search of health being a type of his solicitude. But those who knew Mr. Alabaster at all intimately knew him as a fine type of English gentleman, full of courtesy, sympathy, and urbanity, while as a host he filled the part as to the manner born, perfect in his eagerness to do and to be the correct thing, anxious to make his friends feel at once and absolutely at their ease. During his illness he maintained these qualities and his keen sense of humour never failed even to the very end.

Mere publicity and self-advertisement did not appeal to him. He seldom spoke in public—rather did he fill the rôle of the man of power influencing things silently behind the scenes—loving to know that he was doing work that counted for the general electrical good. To few other men has it been given to have so close an insight into the non-technical affairs of the profession and industry. Known in his earlier days to practically everybody electrical, it had fallen to him to outlive all save a few and from these, or of them, he continued to hear with delight, and it was but natural that in one of his last letters when acknowledging a message passed on from one veteran to another he expressed the sentiment that "the old friends are the best"; because through ripening years they were the ones he knew the best.

Mr. Alabaster had been an Associate of the Institution of Electrical Engineers since 1887; was one of the founders, and joint secretary with Mr. A. M. Sillar, of the Electrical Engineers' Ball; and was also an early member of the Dynamicables. He was one of the founders of the old Electro-Harmonic Society, and on the 21st anniversary of its formation, celebrated in 1906, he, together with Mr. T. E. Gatehouse and Mr. Alfred Izard, were presented with handsome souvenirs. For

some years he acted with the late Mr. Sidney Sharp as auditor of the accounts of the Institution of Electrical Engineers. When the Electrical Contractors' Association was in process of formation in 1901 he presided at a meeting of electrical contractors held at Anderton's Hotel at which the Association was formed, as the outcome of the part that the REVIEW had played in fostering that movement. He was a generous donor to the funds of the Electrical Trades Benevolent Institution, to printing trade and other benevolent funds.

Various other good causes also had his practical support, but for the greater part of his career he devoted himself zealously and with consistent concentration to one single business interest—the journal in which these notes appear. His main concern during 55 years—until comparatively recently advancing years and failing health compelled otherwise—was on the management side of the REVIEW, but the foresight which was present in 1874 when he took action in a field where few had trodden, with full confidence concerning what the future had in store, remained with him until his end, for he believed profoundly in the coming of a great Electrical Era. Just three years ago he wrote to a correspondent: "The times are fast ripening for the electrical world and I wish that I was younger and able to join 'the team' in the onward rush."

Henry Alabaster and his colleagues not only brought to electrical men throughout the Empire and the World an example of unswerving loyalty to the best principles of business, professional, and newspaper life, but a journal which has embodied within it, with the passage of years, some substantial part of the character and mentality of the men who early had such faith in its future.

By middle life he had become a man of robust constitution and this he maintained by living a very active life, travelling, golfing, and motoring, while he was also a great walker. Like his late partner he had musical and artistic tastes, and had a passionate fondness for his garden. During the past few years as life's restraints became more compelling he was an assiduous reader.

In recent years on medical advice, to safeguard his own and Mrs. Alabaster's health, he occasionally wintered abroad, but more generally in Eastbourne or in Devonshire, for England he always loved as Home. London, the place of his birth and business activities, laid claim to him also at the last, for it was from Selsdon Park, Sanderstead, that he passed hence.

Shortly after the death, in 1921, of his former partner and our Technical and Editorial Director, Mr. T. E. Gatehouse, Mr. Henry Alabaster slackened his hold upon the affairs of the ELECTRICAL REVIEW, Limited, and passed the reins of office on to younger hands, though he continued to occupy the position of chairman and director until a few months ago, and was in harness as a director of the company until the end.

When in February, 1924, Mr. Alabaster was entertained by the REVIEW staff and employés at his Jubilee celebration, he alluded with much tenderness and emotion to the devotion with which Mrs. Alabaster had several times nursed him back to life. We have only to mention that Mrs. Alabaster herself has lately been seriously ill, to evoke from many sources the deepest sympathy with her in her poignant grief, and prayers for her speedy restoration to health. To Mr. Alabaster's son—Mr. G. H. Alabaster, the present chairman and one of the managing directors of the ELECTRICAL REVIEW, and to Mrs. Duncan Lyle, his daughter, we desire to tender our deep sympathy, with a thought also for his little grandchildren who were to our old "Chief" so genuine a delight.

In the foregoing account we have tried in a few words to indicate the man Henry Alabaster and his manifold principles, objects, desires, and achievements. But now that he sleeps the sleep from which no human voice can waken, many of us will carry unwritten memory of him in our hearts, and oft shall feel that he

> "Gave his soul to the Common cause and won for himself a wreath which will not fade."

A.H.B.

Thermal Applications of Electricity.

The derivation of expressions whereby the price per kilowatt-hour to compete with coal and gas can be calculated, and a discussion on commercial policy and on progress in Europe and America.

By M. F. HARTMANN and M. L. CHAUVAC, Engineers to the Electricity Department of Strasbourg.
Translated by L. G. A. Sims, M.Sc., Eng.

ELECTRICITY supply companies, after having long confined their activities to the provision of lighting and motive power, have found themselves obliged to seek fresh outlets to improve both load factor and revenue. These they have found in numerous thermal and industrial applications; but whilst the electric motor and electric lighting are definitely established and have acquired an undisputed superiority, the same position does not apply to certain thermal applications of electricity, which has still to struggle with its competitors, gas, coal, or wood, and to justify its economic advantages.

Now a comparison between these at first sight seems very easy, but it is, in reality, rather complicated. The public often forgets, in arriving at hasty estimates, one or other of the elements which determine cost price, and we are not certain that all commercial departments of supply companies have an exact idea of their position relative to their competitors. If it is certain that, in most cases, electricity is supreme, supply authorities should certainly not leave the realisation of this simply to time, but they should give it assistance by judiciously organised publicity and by a tariff policy.

We propose to note briefly a simple method of comparative calculation, inspired by the work of M. Windel.[1] We shall apply this to the case of water-heating by electricity, and we shall show in detail the most important points which determine its development. It is well known that this application of electricity has interest for both the public and the supply authority. The latter can, by means of storage apparatus and night tariffs thereby dispose of a large part of its night energy. The classic example, and one which is probably unique in its kind in Europe, is that of the town of Bâle, which, with a population of 140,000, has more than 6,100 water heaters installed, with a capacity of 12,500 kW. A practically, horizontal load curve has thus been obtained, so

[1] Walter Windel. "Hochstpreise für Elektrowärme." Elektrotechnische Zeitschrift. November 12th and 19th, 1925, pages 1721-1730 and 1771-1775.

that, since 1925, the night load has never fallen below 60 per cent. of the peak load. In France the example may be quoted of the Electricity Supply Department of Strasbourg, which has 1,300 heaters connected, representing a load of 2,150 kW.

Furthermore, the electric water heater, of all domestic apparatus, has much the largest current consumption. This is of the order of 2,000 to 3,000 kWh per household per year for bathroom apparatus of an average size of about 27½ gallons, and this does not represent the maximum possible. It will be noticed further that this type of load is not inductive and that it assists in improving the power factor of the network, which is low during the night.

The comparison is arrived at by taking the price per unit K_e as unknown, and by including all charges, namely, expenditure of energy or of fuel (coal, gas, or wood), charges on the installation (interest and depreciation), renewals, labour, repairs, and finally hire of measuring apparatus. The maximum value $K_{e\ max}$ that the price per unit may reach is calculated on the assumption that corresponding charges are equal for the different competing sources of energy. A price is thus obtained which the kilowatt-hour should not exceed in order that parity may exist between electricity and the particular competitor concerned.

It will be realised that, in practice, electricity has advantages such as convenience and cleanliness which can hardly be expressed in figures, but which really permit an appreciably higher price. (The advantage of electrical apparatus from a hygienic point of view, compared with apparatus using gas, is made very clear by the fact that five to six cubic feet of air are needed for the combustion of one cubic foot of gas, an undesirable state of affairs in bathrooms, which are often small and ill-ventilated.

Three values of the maximum price per unit are calculated :—

$K_{e\ max}$ which takes account only of the energy costs.
$K'_{e\ max}$ which takes account of the total costs, except the hire of metering apparatus.
$K''_{e\ max}$ which takes account of all costs.

Formulæ which are to be valid for all thermal applications of electricity call for the introduction of certain factors: efficiencies, calorific values, purchase prices, maintenance charges, hiring rates, &c., the determination of which is rather precarious, and which vary very much according to the types of apparatus, the greater or less care given to their upkeep, and the districts concerned. It behoves each person to study his own particular case in order to determine the average values to be used. It will be found to be of interest to note exactly the competing conditions and apparatus, and, if necessary, to carry out a few tests on certain of the appliances for those cases which occur most frequently.

Derivation of Formulæ.—We shall use the following designations, employing the suffices, e, g, c, w, for values applying, respectively, to electricity, gas, coal, and wood.

K_e = general symbol for selling price per kWh (1 kWh = 3,410 B.th.u.).

$K_{e\ max}$, $K'_{e\ max}$, and $K''_{e\ max}$ = maximum prices per unit as defined previously.

R_e, R_g, R_c, R_w = percentage thermal efficiencies of installations.

H_e, H_g, H_c, H_w = period of operation of apparatus in hours per year. (This is not necessarily identical with the period of use, starting-up, &c.)

A_e, A_g, A_c, A_w = total cost of apparatus in pence.

B_e, B_g, B_c, B_w = total cost of apparatus per kilowatt = A/L_k.

L_k = total power of the apparatus in kilowatts.

L_t = heat equivalent of $L_k = (L_k \times 3{,}410)$ B.th.u.

P_e, P_g, P_c, P_w = charges other than energy costs, as percentages of cost of apparatus per kilowatt.

These charges are :—

1. Interest and depreciation = P_1
2. Renewals = P_2
3. Maintenance = P_3
4. Repairs = P_4
5. Miscellaneous = P_5
6. Total = P

W_g, W_c, W_w = calorific values per pound or per cubic foot of fuel in B.th.u.

F_g, F_c, F_w = purchase prices of fuel in pence per pound or per cubic foot.

C_g, C_c, C_w = theoretical consumptions of fuel per equivalent kWh in cubic feet or pounds.

T_{he}, T_{hg} = annual charges for meter hire.

T_e, T_g = annual charge per kilowatt for meter hire.

Formulæ giving maximum prices per kilowatt-hour.—

1. Taking account of all charges, the running costs per annum amount to :—

$$(K_e\ H_e/R_e) + B_e\ P_e + T_e$$

per kilowatt of energy available from the electrical apparatus.

For the competing apparatus the annual expenses amount to

$$(F\ C\ H/R) + B\ P + T$$

per equivalent kilowatt.

Equal competition will exist when the above quantities are equal. Equating these we obtain the maximum allowable price per kilowatt-hour in the following form :—

$$K_{e\ max} = P_e\ H/H_e\ [F\ C/R + (B\ P - B_e\ P_e)/H + (T - T_e)/H] \quad (1)$$

2. Omitting hire of metering apparatus we have :—

$$K'_{e\ max} = R_e\ H/H_e\ [F\ C/R + (B\ P - B_e\ P_e)/H] \quad (2)$$

By comparing $K'_{e\ max}$ with $K''_{e\ max}$ the influence which is exerted by the hire of metering apparatus may be observed.

3. Taking account only of fuel or energy costs, the formula becomes simplified to :—

$$K_{e\ max} = (H/H_e)\ (R_e/R)\ (F\ C) \quad (3)$$

The case of comparison of apparatus whose principles of action are different.—In the case of comparison of apparatus having different principles of action, for example, storage apparatus compared with a direct-flow instantaneous geyser, the useful power will differ considerably, though each has the same energy input. The calculation is then made, using the total useful power of each. (L_e = power of the electrical apparatus, L_g = power of the gas apparatus).

If the formulæ are developed as below it is not necessary to fix the power or the period of use of the instantaneous apparatus.

1. Taking account of all charges we have

$$[(K_e\ H_e/R_e) + B_e\ P_e + T_e]\ L_e = [(F_g\ C_g\ H_g/R_g) + B_g\ P_g + T_g]\ L_g$$

and by putting

$$B_e\ L_e = A_e \text{ and } B_g\ L_g = A_g$$

we have

$$(K_e/R_e)\ H_e\ L_e + A_e\ P_e + T_{he} = (F_g/R_g)\ C_g\ H_g\ L_g + A_g\ P_g + T_{hg} \quad (4)$$

Let the energy used for the production of the hot water be equal in the two types of apparatus. Then $(H_e\ L_e) = (H_g\ L_g)$; H_e and H_g being the periods of actual use.

Then by substitution in (4) we have

$$K''_{e\ max} = P_e/H_e\ [(F_g/R_g)\ H_e\ C_g + (A_g\ P_g - A_e\ P_e)/L_e + (T_{hg} - T_{he})/L_e] \quad (5)$$

2. By neglecting the hire of meters and time switches we have :—

$$K'_{e\ max} = P_e/H_e\ [(F_g/R_g)\ H_e\ C_g + (A_g\ P_g - A_e\ P_e)/L_e] \quad (6)$$

3. Considering energy costs only we have :—

$$K_{e\ max} = (B_e\ F_g\ C_g)/R_g \quad (7)$$

This equation necessarily implies that the period of use is equal to the period of operation.

[1] The period H between the time when the apparatus is put into operation until the time when it is shut down is always equal to, or greater than, the true period of use. It is the full value H which should be used in the formulæ above.

(To be concluded.)

A Large Cigarette Factory Electrical Installation.

Electricity is used extensively for all purposes, including lighting, power, and in connection with the air-conditioning plant at Arcadia House, the new factory at Mornington Crescent of Carreras, Ltd.

IT is a fairly safe conclusion nowadays that where there is much general interest shown in any industrial development, there is also to be found much of electrical interest. It was with that feeling of confidence that we approached those responsible for the electrical work at Arcadia House, the new cigarette works at Mornington Crescent of Carreras, Ltd. We were not disappointed.

Arcadia House, fig. 1, is said to be the largest single-block manufacturing building in London. Its elevation represents nearly a third of a mile; it has a volume capacity of about six million cubic feet, and its total floor area is something like nine acres. Over 50,000 tons of special concrete were used in the construction of the building, with 2,500 tons of steel reinforcement. The whole factory may be generally described as of the best, and the electrical installation is certainly no exception.

Fig. 1.—Arcadia House, the New Cigarette Works of Carreras, Ltd.

The main contract for the electrical equipment and work was awarded to Messrs. Marryat & Place, and it is a creditable point that they designed and carried out the whole of the work without the assistance of an outside consulting engineer. The installation represents a total working load, continuous over the ordinary working hours, of 1,000 kVA, while about 300 kVA is used continuously, day and night, in connection with the air-conditioning plant. Practically the whole of the power load is on demand continuously during the working hours, with the result that the installation load factor—over the working period only—is 90 per cent. Over 400 electric motors of sizes varying from ½ h.p. to 45 h.p. are employed throughout the installation, and they are all of totally enclosed dust-proof construction, and are fitted with enclosed ball bearings, so as to avoid the necessity of oiling. The majority of the motors were supplied by the General Electric Co., Ltd.

It is typical of Carreras in their determination to have of the best of work and equipment in connection with the production of their wares that the use of rubber —except the covering of cables enclosed in screwed steel tubes—was absolutely forbidden. About 150 miles of cable and wire are employed for the power and lighting distribution throughout the building, the whole of which was supplied by Messrs. W. T. Henley's Telegraph Works Co., Ltd.

Duplicate feeders, each of 3,000-kVA capacity, are brought into a basement room under the forecourt direct from the 5,000-volt, 3-phase busbars at the St. Pancras Borough Council generating station. Reyrolle drawout-type switchgear, fig. 2, receives the incoming supply, and distributes it to the two transformers of like capacity shown in fig. 3. The five switch units, two incoming, two outgoing and one coupler, have a rupturing capacity in each case of 350,000 kVA. The transformers are of the oil-circulating air-cooled type, and were supplied by Messrs. Bruce Peebles & Co., Ltd. The transformer ratio is 5,000 V to 415 V. A feature is that they are overwound to 600 V on the l.p. side, and two static condensers, fig. 5, by which approximately unity power factor is maintained for the installation, are connected across the 600-V tappings. The condensers were supplied by the Telegraph Condenser Co., Ltd. They are of the oil-immersed type, each of 250-kVA capacity, and are fitted with oil-immersed time-lag control gear.

The main switchgear is so arranged that either feeder or either transformer can be put in or out of service without affecting the other, and the system may be indefintely extended for additional transformer units as required.

Distribution throughout the building is effected at 415 volts, 3-phase for power, and 240 volts between phases and neutral for lighting. In the transformer chamber is a circuit breaker and limiting resistance connected in the earth circuit. The whole of the iron casing of the switchgear and the steel conduit throughout the building is connected to the neutral bar and earthed at that point. The earth plate, buried under the pavement of Mornington Crescent, and all connections to it are of 1,000-A

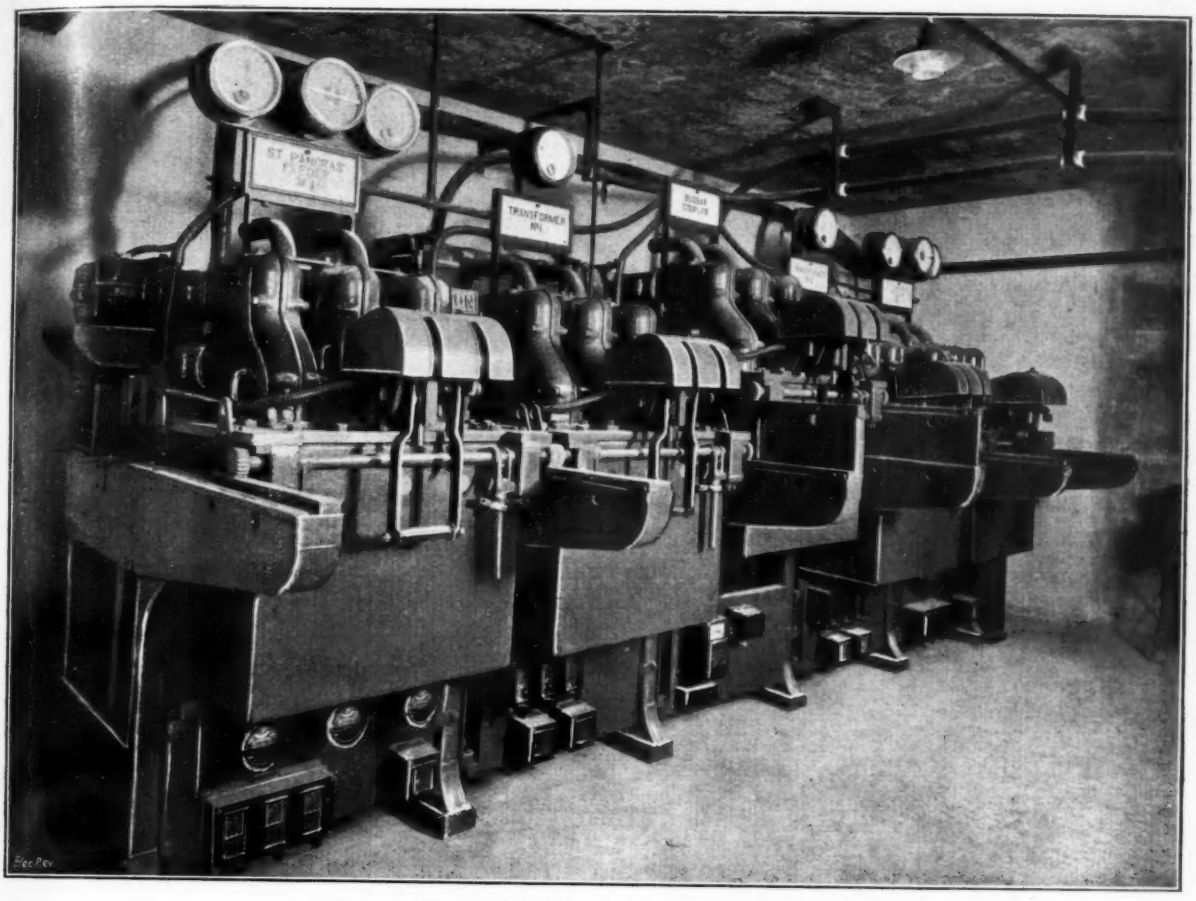


Fig. 2.—The Main Switchgear at Arcadia House.

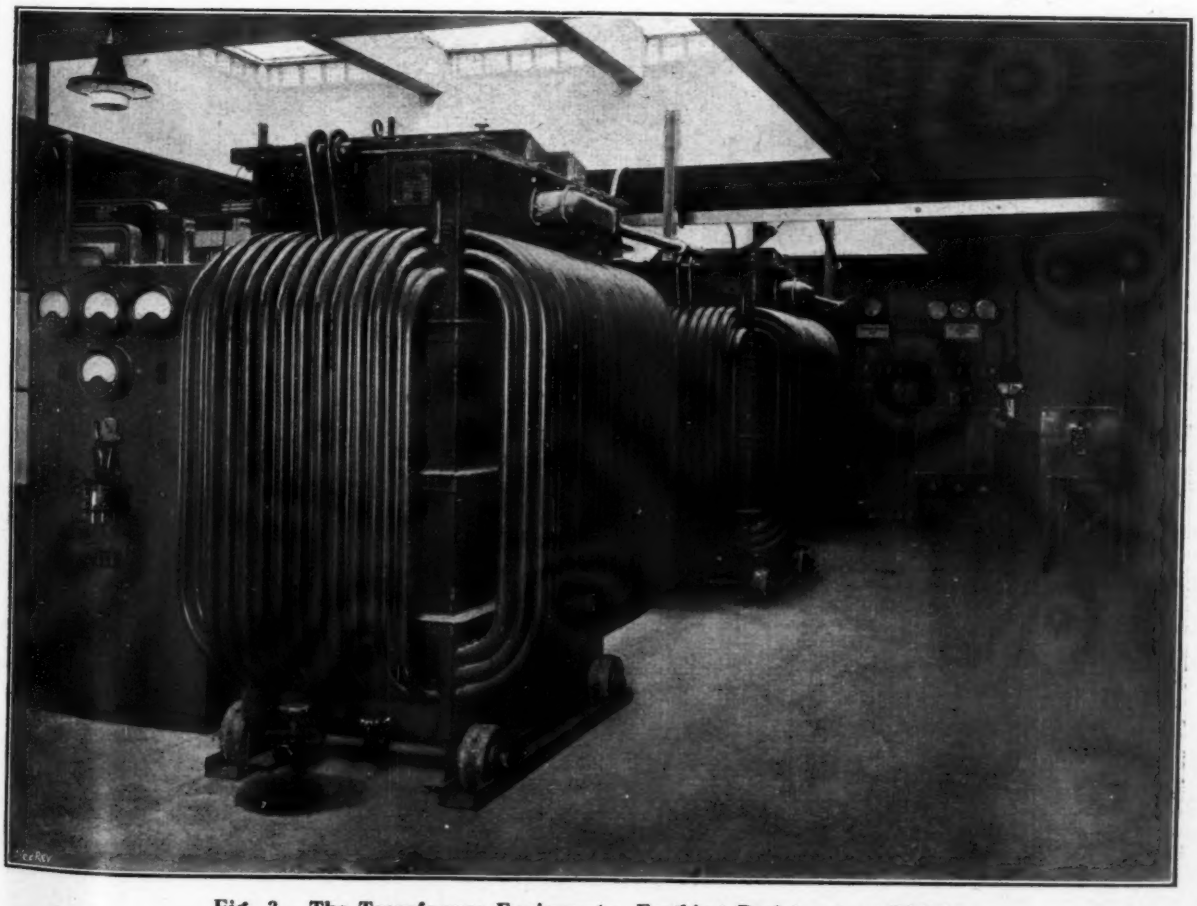


Fig. 3.—The Transformer Equipment; Earthing Resistance on Right.

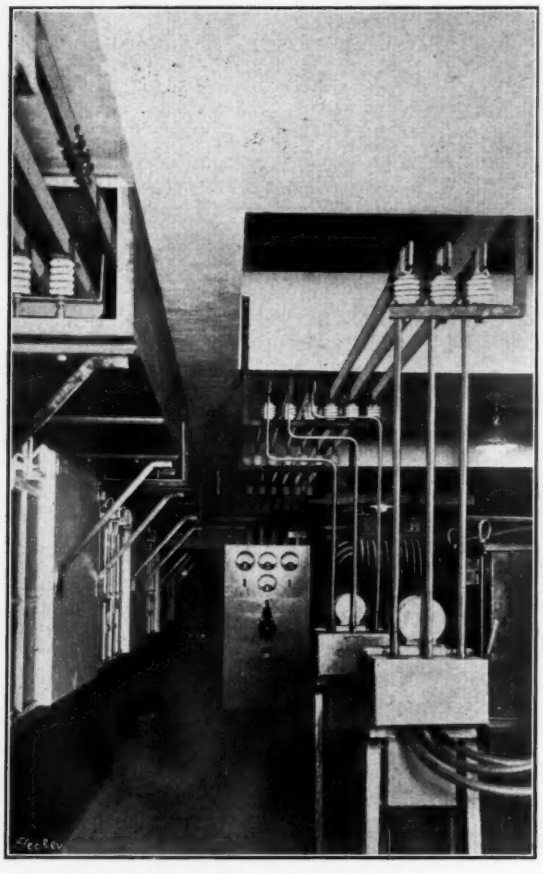


Fig. 4.—Main Busbars and Connections.

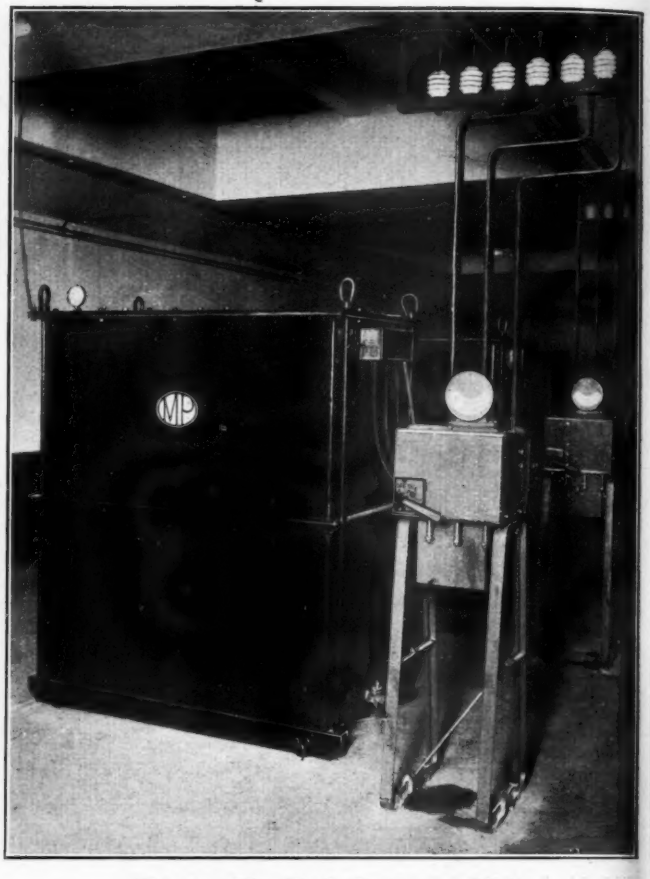


Fig. 5.—The Static-Condenser Plant.

Fig. 6.—Wiring in Cable Trench.

Fig. 7.—Portion of Conduit Rise.

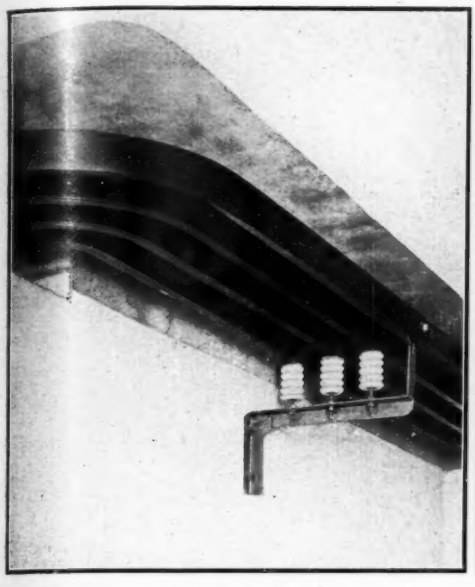


Fig. 8.—A Difficult Busbar Run.

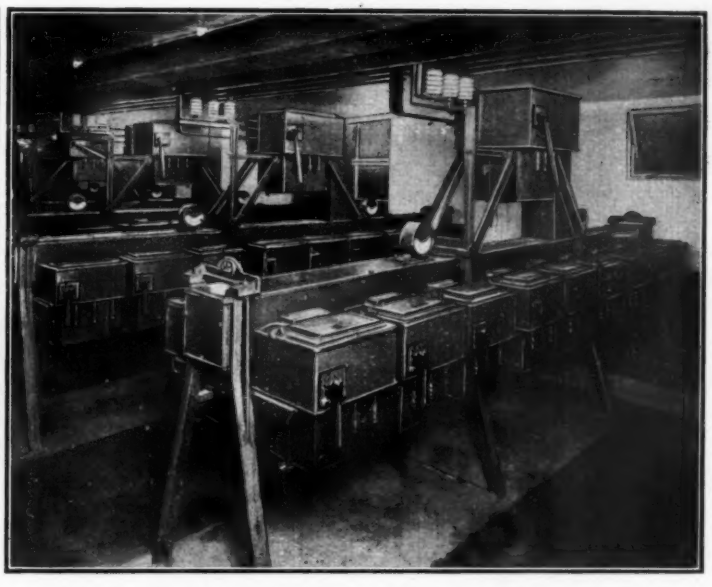


Fig. 9.—The Main Distribution Room; 180 Circuit Breakers.

Fig. 10.—High-speed Cigarette Machine.

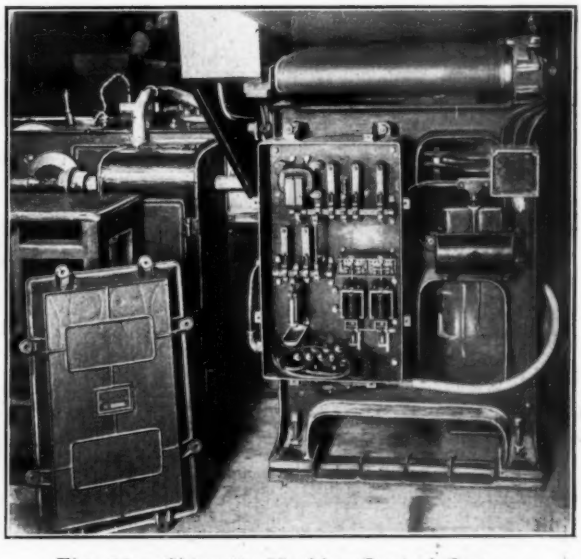


Fig. 11.—Cigarette Machine Control Gear.

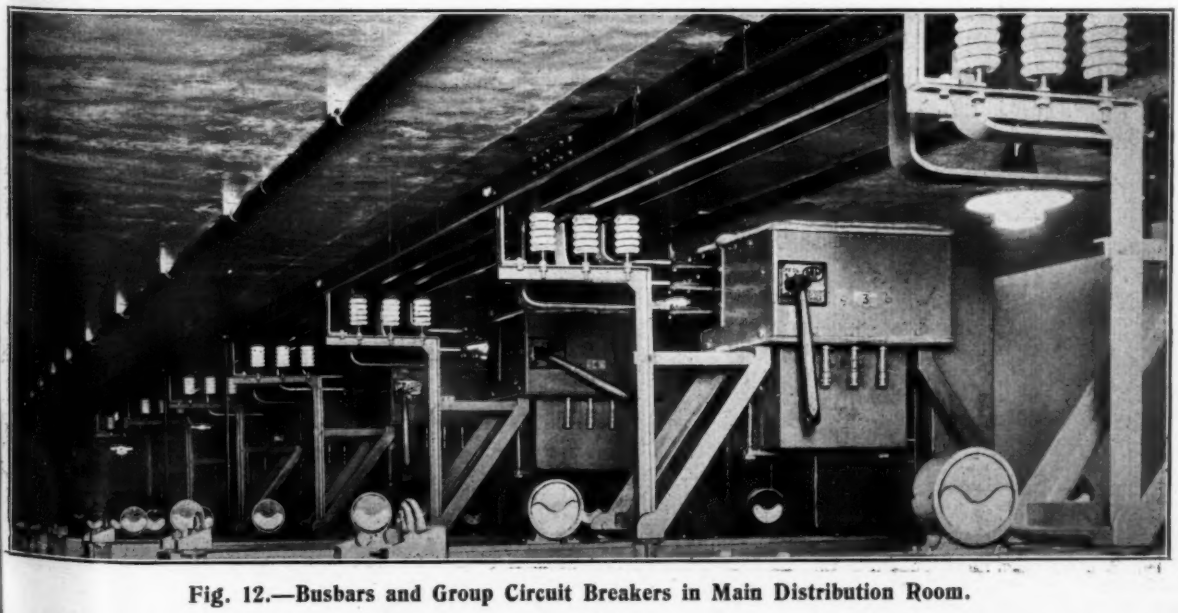


Fig. 12.—Busbars and Group Circuit Breakers in Main Distribution Room.

Fig. 13.—Automatic Passenger Lift.

Fig. 14.—One of the Goods Lifts.

Fig. 15.—Typical Example of Lighting at Arcadia House; Picking Room.

capacity. A small current transformer fixed on the earth bar registers the leakage current in the engineer's office two floors above.

The construction of the main busbars is depicted in figs. 4, 8, and 12. There are four bars, the fourth and neutral being bolted to the steel framework carrying the porcelain insulators for the phase bars. The bars are of aluminium, and each is made up of three strips of that metal, each strip being 3 in. by $\frac{3}{8}$ in. section. The bars are butt jointed, the joints in the separate strips forming each bar being staggered. The bolts are of galvanised-iron. Fig. 8 is of interest in that it shows the particularly neat job made of a difficult section of the busbar work. In the distributing rooms these bars feed nine banks of switchgear, some of which are shown in fig. 9. Each bank comprises one 1,000-A main oil breaker, a central sub-busbar chamber, and 18 circuit breakers, each of 100- to 200-A capacity, also of the oil-immersed type, arranged nine on each side and fitted back to back against a sub-busbar chamber. These circuit breakers are connected to the sub-busbars and feed 180 main cable circuits leading to sub-distribution boards.

The cables from the circuit breakers are collected together in a steel trough beneath the sub-busbar chamber, and at the right-hand end of the bank the cables are led down through a metal conduit to an underground trench in which each pair or set of three is separately supported and conducted to a concrete subway in which they are carried in separate 2-in. pipes into the main building, where there are two separate rises of conduits, one on either side of the block. Fig. 6 is a view of the cable work in the trench in the distribution room, and fig. 7 depicts a portion of one of the cable uptakes from the floor to the ceiling on one of the floors. This method of handling the great mass of heavy conduits and cables is particularly interesting in itself; elaborate provision was made for the arrangements in the construction of the building.

A small d.c. pilot and emergency lighting service is run throughout the building, and is supplied from the St. Pancras d.c. network and metered and distributed in two 200-A main circuits from a suitable switchboard.

To deal with the applications of electricity to the various processes throughout the works, tobacco, after being released from bondage on the site, and with the leaves stripped of their stalks, is fed into guillotine cutting machines where it is prepared for actual cigarette making. These cutting machines are each fed by a 3-h.p., 3-phase motor with straight-on switching. The control gear is of very simple design, employing t.p. contactors with push-button operation. The contactors have a short overload time lag and represent one of the three types of controller standardised throughout the factory. The other two have, in one case, a longer overload time lag, and provide for stopping, starting, and inching, and in the other case, no time lag and serve for just on and off switching.

These motors, in common with most of the others employed, are designed for 40 deg. C. temperature rise. On this floor there is also a large grinding machine for dealing with the stalks removed from the tobacco leaves. This is driven by a 45-h.p. motor, 2,800 r.p.m. The grinding of the knives employed by these cutting machines is responsible for a considerable amount of work and also of electrical energy. In the grinding room there are several grinders driven by 8-h.p. motors.

The operations so far referred to are carried out in the basement, and the next series of operations, the actual cigarette making, is carried out on the fourth or top floor. Here are several groups of cigarette-making machines, including, it is claimed, some of the fastest and most perfect cigarette machines in existence.

Fig. 10 shows one of these machines, which were designed and manufactured on the engineering floor of Arcadia House. The features of particular note in connection with these machines are the compact driving arrangements by 3-phase motors, and the simple and efficient control gear. The latter, fig. 11, which was designed and made specially by Messrs. Marryat and Place, provides for push-button starting, stopping, and inching. These squirrel-cage motors are specially designed to accelerate to full speed in 5 sec. The starting torque is 14 h.p., and the running torque 2.6 h.p. Each cigarette machine is served with three separate electricity supplies, a three-phase supply for the driving motor already referred to, a single-phase supply for heating, and a d.c. supply for energising electro-magnets. There are two heaters, one a small 12-W appliance of special design to keep the paste in the correct condition, designed by Carreras engineering department and made by the G.E.C.; the other is a 300-W heater made by Carreras for drying the cigarettes after their formation and before cutting. The heaters on the machines are served by specially made flexible leads, asbestos insulated, without rubber, supplied by Henley's.

The electro-magnets are employed for extracting minute pieces of metal from the cutting knives, &c., from the tobacco as it passes into the machines. The d.c. supplies are provided by nine $1\frac{1}{2}$-kW motor-generator sets arranged in groups about the floor. The generators are compound wound. The sets were supplied by the G.E.C. and they are controlled by "Crompton" switchgear. The cigarette machines are arranged in groups of from eight to twelve, and each group is controlled by one circuit breaker through a "Fluvent" distribution board.

From the fourth floor the cigarettes are taken by electrically driven endless-chain conveyors to the intermediate floors for packing and allied operations. All the packing machines are driven by $\frac{3}{4}$-h.p. s.c. motors, fitted with ball and roller bearings. The motors are all arranged for direct starting with push-button control. The machines are all fully automatically protected, so that there is no use for electrical overload. On the machines which provide for the wrapping of tins of cigarettes a single-phase supply serves for drying the paste, and is conveyed to the necessary heaters by specially designed Empire-tape insulated and aluminium-armoured cable, also supplied by Henley's. A number of tin-beading machines are driven by specially designed high-torque motors. These have a running output of 2.6 h.p. and a starting demand of 15 h.p. Disking machines for capping tins form another feature of this department, and are served by $1\frac{1}{2}$-h.p. motors with straight-on starting. Soldering machines in which the joints of tins are drawn through flux and solder are served by two motors operated from the same controller. A 1-h.p. motor drives the conveyor portion of the machine and a $1\frac{1}{2}$-h.p. motor drives a small gas compressor for the gas supply to the solder bath. Other interesting items in this section include a variety of labelling machines, all controlled by push buttons.

The lighting installation at Carreras new building represents a particularly creditable piece of work. There are over 2,000 lighting points in the installation, and the system is designed to give an average lighting intensity of 6.5 ft.-candles throughout the building at a plane of 2.5 ft. above the floor level. All the holes required in the concrete floors for the tubes feeding the points were marked off and cast in the structure during erection. "Benjamin Biflector" type fittings are employed throughout the premises, except in certain special places mentioned below, and the resultant illumination is very pleasing. Fig. 15 is a typical example of the general lighting. It is a night view in the stripping room; the effect is almost shadowless.

The general lighting scheme was designed by Benjamin Electric, Ltd., and the work was carried out by Messrs. Marryat & Place. The beautiful effects which complete the board room and principal offices, together with the unique arrangements and the lighting of the entrance loggia, were designed by Messrs. M. E. and O. H. Collins, the architects for the building. In the board room light is largely obtained from translucent panels of Egyptian design, forming the upper part of the pilasters which are a feature of the room. In the loggia an effect of moonlight is obtained by a battery of twenty-six mercury-vapour lamps concealed in channels, the light from which, about 30,000 c.p., is reflected through a coloured-glass soffit of special design. It is of interest to note that in connection with the inspection of cigarettes Carreras engineering department

is at present designing a system to project illumination from the direction of the source of natural lighting at an angle of about 45 deg. to the inspection plane. This is calculated to aid the examination of the packing of the tobacco in the cigarettes by reason of the shadows cast.

An interesting feature of the electrical installation is a visual signalling system, which has been adopted to arrest the attention of certain officials in any part of the building. Signalling lanterns are disposed at convenient points on all floors, and are arranged to give illuminated ruby-glass signals 0 to 9. This is effected by 25 lamps in each lantern, so controlled that they may be switched on in ten different groups to give the required signals. A twenty-core cable from the controlling point is connected to all the signalling points. A complete 250-line Relay telephone system is installed throughout the building.

The air-conditioning plant, which was installed by the Carrier Engineering Co., Ltd., provides for the blowing of steam-heated and dry water-saturated air through suitable ducts throughout the premises, and electricity is used extensively for pumping and fan driving, and so on. The air, which is drawn in at various points from outside the building, is treated in specially designed chambers of which there are a total of 13 in the installation. These vary in size, and the largest fan motor employed in connection with the system is of 37 h.p. "Bull" motors are used extensively.

Of course no modern industrial building can nowadays be considered complete without being adequately served by electric lifts, and in this respect Arcadia House is certainly not lacking. For the lift installation, which includes an automatic passenger lift and five large goods lifts, Messrs. Marryat & Scott, Ltd., a subsidiary company of Messrs. Marryat & Place, is responsible. All the lifts employ motors with direct-switch-on operation, and probably the main feature in connection with the lift equipment is simplicity coupled with effective control. In the passenger lift, fig. 13, which is served by a 10-h.p. Crompton Parkinson motor and has an accelerating and decelerating speed of 120 ft. per min.; a row of numbered buttons is arranged so that the passenger has simply to press the button which bears the number of the floor to which he wishes to travel, and the rest is entirely automatic. The greatest precautions for safety have been taken in the construction of this lift. The solid outer door has behind it in the lift cage a collapsible bronze gate; until the door is shut and actually locked, and until the expanding gate is also fully closed, the lift refuses to move. The goods lifts, fig. 14, are built for very rough usage. The cages weigh almost 2 tons, and the machines have a carrying capacity of about the same weight. The cars are steel lined, with double floors and double timber side backings. The starting arrangements are very simple; a lift cannot start until both the sliding doors and expanding gates are fully closed and automatically locked.

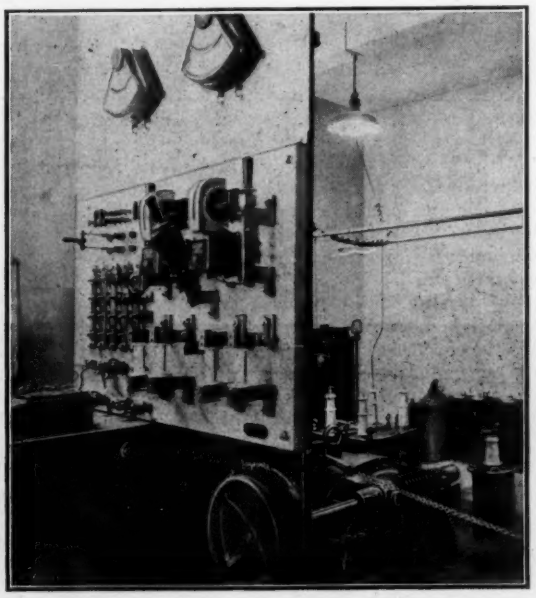
In conclusion, we are indebted to Carreras, Ltd., for permission to view the factory and publish the above information and photographs, and also to Messrs. Marryat & Place for their help in the preparation of the above notes and for the illustrations.

Electricity Meter Testing.

An account of the recently completed laboratory of the Compagnie Parisienne de Distribution d'Electricité, France.

By CHAS. J. WEBB, A.I.A.E.

ELECTRICITY meters play so important a part in the financial success of electricity distribution systems that most large undertakings nowadays find it necessary to maintain well-equipped departments for the testing and supervision of their meters, as well as such safety devices as fuses, switches, &c. As an example of a modern department of this kind I am able to give some particulars of the special central meter-testing laboratory recently completed in Paris by the Compagnie Parisienne de Distribution d'Electricité, for the illustrations accompanying which I am indebted to Mr. P. Maurer, chief engineer of the section, who points out that the work undertaken is of a varied character and is not restricted to the tasks undertaken in the laboratory.



Figs. 1 and 2.—Alternating-current Test Room.

One of the principal functions of the section is that of supervising the purchase and manufacture of electricity meters and the supervision of the acceptance tests

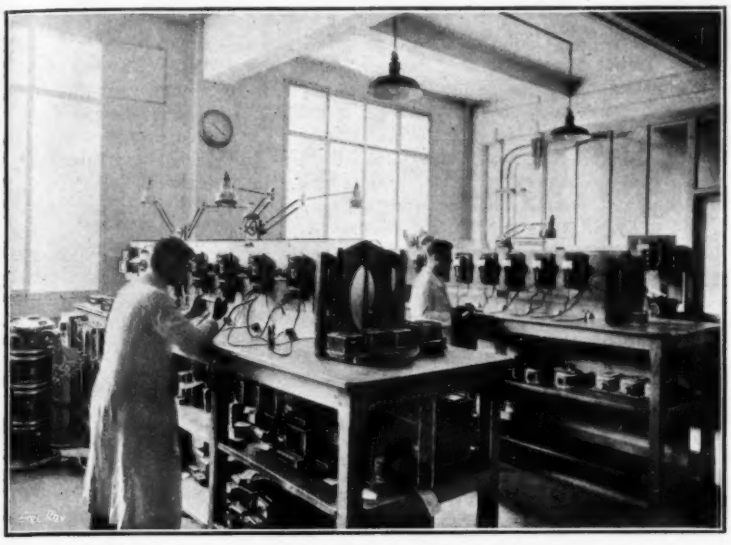


Fig. 3.—Meter Standardising Department.

either at the factory or in the company's laboratory, to which is added the work of testing meters installed on consumers' premises and, when necessary, the carrying out of any repair or reconstruction work. Complete records of tests are kept, of course, as from them much useful information is obtained about the general causes of faulty operation, so that steps can be taken to overcome them by improvements in meter details.

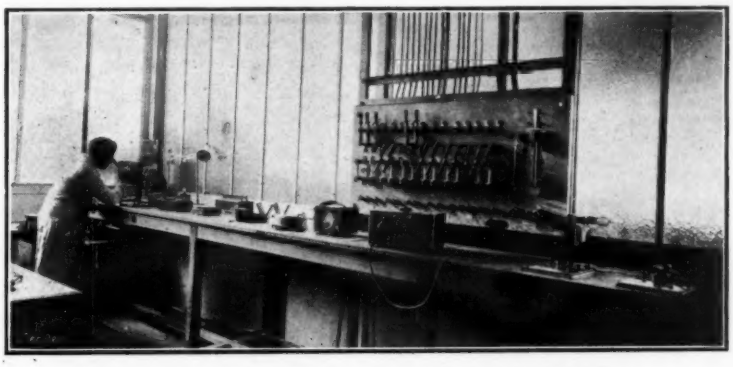


Fig. 4.—Checking the Accuracy of Testing Instruments.

Each day a number of meters are received that need repair. They are first carefully inspected to ascertain the class of repair work that is necessary, it being part of the duty of those entrusted with the actual work of repair to so record the fault that it can be filed. From the repair shop the meters pass to the testing or standardising section, after which they are passed to the store ready for re-issue. Meters belonging to consumers have also to pass through the company's testing department before being put back into use.

Apart from the testing of meters, the department has also to test from time to time the portable instruments used for testing meters on the consumers' premises, and also the various measuring instruments used at the power stations and at the different sub-stations, records of all of which are carefully collated. In addition, a good deal of work is done in the laboratory in connection with the testing of fuses, switches, cut-outs, special relays, and comparative tests of different instruments intended for the same purpose.

Turning from this brief general survey of the work undertaken, one may pass to a short description of the department in Paris over which Mr. Maurer presides, which is responsible for the maintenance and testing of no fewer than 680,000 electricity meters of varying types, with an annual increase of about 60,000 meters. About two-thirds of the total consists of single- and two-phase a.c. meters, the balance comprising d.c. amp.-hour meters up to 10 A, and watt-hour meters above that rating.

The extent of the distribution area of the Parisienne Co. is such that Paris has been divided into a number of sections, in each of which provision is made for the installation, maintenance, and testing of meters in its respective zone.

So far as the portable meter-testing instruments employed are concerned, they are mainly intended for use in connection with small-capacity meters, which represent 85 per cent. of the total in use; they are of the direct-reading type in order to enable 65 per cent. of the meters installed to be tested *in situ* each year. When faults in meters are recorded experience shows that they mainly arise from a relatively few causes, chief amongst which are defects in the pivoting components, the renewal of which represents on the average 13 per cent. of all the necessary repairs.

In addition to the meters already alluded to, the Paris distribution system comprises 675 h.p. transformer cabins in which both h.p. and l.p. meters are installed, the number of cabins increasing at the rate of from 70 to 80 per year. Not only have they to be supervised, but, owing to the scale of charges in force, about 2,500 reactive-energy meters and 2,100 variable-tariff meters with clocks or distance-controlled relays have also to be looked after. This does not exhaust the tasks of the meter-testing department, which is also responsible for the testing of 6,000 indicating instruments, including volt, ampere, watt, and phase meters, and about 1,200 relays; from 100 to 200

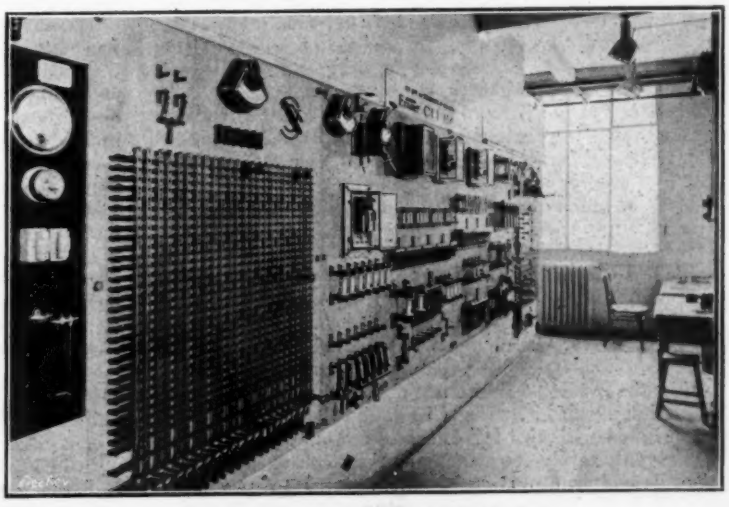


Fig. 5.—View of Main Switchboard.

tests per year of generators and transformers have also to be conducted. Apart from the tests, the number of meters, clocks, relays, rheostats, &c., which have to be repaired represents an average of 7,000 per year, as well as from 400 to 500 other measuring instruments.

The new central laboratory that has been established to meet the growing requirements, which is the subject of the accompanying illustrations, occupies an area of about 8,400 sq. ft. and is equipped with all the latest appliances. In the basement are the stores, a h.p. cabin, and the machine room, while on the ground floor are the meter-repairing shops, a clock-mechanism department, a meter-standardisation room, and a meter spare-parts store; the arrangement of the different rooms one to the other is such as to obtain maximum efficiency from the staff, which consists of about 80 persons, including the workmen. To facilitate the work the repair shop is provided with a number of separate tables with benches, each of which deals with one type of meter. In the meter standardising room (fig. 3) there are six benches—three for d.c. and three for a.c. meters. The three d.c. tables are fitted with instruments to deal, respectively, with meters of from 1 to 20, 1 to 100, and 1 to 1,000 A, while those for a.c. meters are separately equipped for 1 to 20, 5 to 500, and 10 to 1,000 A instruments, provision being also made for testing active-energy meters with lag-adjusted current and of re-active energy meters.

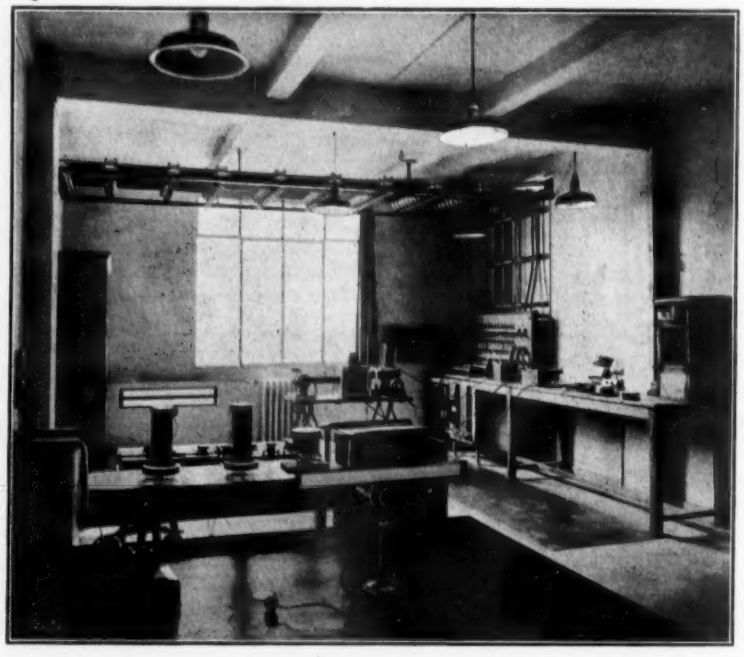


Fig. 6.—Precision Test Department.

The laboratory proper is located on the first floor, being divided into a number of rooms; one of these is devoted entirely to experimental work; two are used for the standardisation of measuring instruments and relays, one for a.c. h.p. and l.p. tests, one for precision tests, and one for general tests of fuses, small cut-outs, switches, and like devices. Much of the work in the experimental room consists of designing and testing new meters and other measuring instruments. Fig. 4 is a view of one of the rooms devoted to the standardisation of the measuring instruments used for control purposes. The principal bench is divided into two sections, one for d.c. and one for a.c., the layout being such as to enable tests to be made very rapidly. As will be noticed, the current supply sources are conveniently grouped on a wall board in the centre. The a.c. testing room is regarded as one of the most important in the building; it is broadly divided into two sections, in one of which (fig. 1) are located two transformers of capacities and ratios of, respectively, 60 kVA and 220/12,000 V, and 6 kVA and 150/15,000/30,000 V; voltage and current variations within the available limits are obtained by means of an induction regulator. The other part of the room (fig. 2) is equipped with two test benches, one of which obtains its current supply from a Bonnier set consisting of two two-phase alternators, one of which, giving 4 A per phase at 220 V, is known as the constant-voltage adjustable stator machine, while the other giving, 500 A per phase at 4 V, is termed the current alternator. The second bench receives its single-phase a.c. supply at 220 V and at frequencies ranging between 250 and 1,200 cycles per second from a special set in the machine room. The precision test room (fig. 6) comprises, generally speaking, two tables on which are fitted pillars supporting precision galvanometers. There is also a Wheatstone bridge by means of which resistances ranging from 1/1,000 ohm to 1 megohm can be measured, a potentiometer with a range of from 1 to 12,000 V, and a group of instruments connected to a resonance galvanometer for the measurement of the ratio of transformation and lag adjustment of the measuring transformers. Special lines with carefully-determined resistances terminate in the other testing rooms by means of which it is possible to effect the measurement of resistance and differences of potential at a distance.

Other than that the switchboard is connected to the total power available in the laboratory for the testing of fuses, small controllers, &c., the general test room calls for no special description. The second floor is devoted to offices and record-keeping departments, while on the top floor is a battery room.

The electricity supply system of the building comprises two distinct circuits, one for lighting and operation of the motors of the lifts, and one for supplying the various test benches; particular attention had to be devoted to the latter, owing to the diversity of the kinds of current necessary. For the latter two main sources are available: a h.p. transformer cabin at 12,500 V and a d.c. branch (2 by 100 V, 500 A) located in the machine room. In the cabin are two transformers; one has a capacity equal to 120 kVA and converts the h.p. supply to two-phase for a four-wire circuit at 220 V; the other is of 100 kVA and feeds a commutator supplying d.c. at 115 V, which can be converted for d.c. testing purposes to 440 V by means of a 75-kW convertor set. In the machine room are also two battery-charging sets, a d.c. to a.c. transformer, and a high-frequency set. In the accumulator room are two sets of batteries, each with six elements and of 300 amp-hour capacity, a 60-element series-connected 92-ampere-hour battery used for feeding the Bonnier set, and a 46-ampere-hour 240-element battery. Thus the laboratory has at its disposal single-phase and two-phase a.c. at both high and low voltages, d.c. at 115 V, 2 by 110 V, and 440 V, and a supply at high frequency. All the supply and charging conductors are centralised on a special grouping board on the first floor. Each test room is of course also equipped with its own switchboards.

Kerbstone Advertising in Paris.

A new style of publicity device is to be experimented with in Paris. This consists of a thick pane of glass let into the pavement of the streets with a mirror underneath. At night electric lamps shining on the mirror will cause the reflection of an advertisement to appear on the glass, while in bright sunlight a similar effect will be produced. Advertisers will be able to rent space at the rate of £3 6s. a meter.

Telephonic and Verbal Orders.

In this article the author discusses the legal questions which are involved when goods are supplied without a written requisition.

By W. ERIC JACKSON, LL.B., Barrister-at-Law.

A NUMBER of recent cases in the Courts dealing with the giving of orders to travellers, or over the telephone, indicate that there are still many traders who either do not know the rules of the law regarding contracts of this kind, or do not trouble to exercise them in their business. In Yorkshire recently the police issued a notice warning all traders to take special care in receiving and executing orders received by telephone, since the number of frauds which have been perpetrated by such means is reaching an abnormal scale. The execution of orders without legal formality is not only frequent but often very convenient. Goodwill and speed have to be taken into account, and parties do not always rely on their strict legal rights. Nevertheless, it is as well to be aware of the legal position in order to avoid a false impression of the rights and liabilities which arise from an informal sale.

Writing is not legally necessary to a valid and enforceable contract of sale. In this way there is nothing to prevent the enforcement of a contract made on the telephone for the sale of goods. But there must be evidence of some kind, if writing is not used, and the Sale of Goods Act states what this is to be. When the goods are of less than £10 in value no formality is necessary. The parties can prove the contract by any evidence, verbal or otherwise. But if the goods are of £10 in value or more then one of four types of evidence must be obtained before the contract can be proved at law. The four types are as follows:—There must be either some part payment in respect of the goods, or some part delivery of them, or there must be a deposit paid, or there must be some note in writing signed by the alleged buyer.

Hence if goods are ordered on the telephone and delivered, and the fact of delivery can be proved, then the contract can be enforced. But if the buyer's messenger comes and fetches the goods it is difficult to prove that the goods were delivered to the buyer unless the person who fetches the goods shows some authority or produces some evidence that he is the buyer's representative. It is necessary to have this evidence to be able to enforce the contract, because if a fraud is committed and the goods are stolen by the messenger who comes for them, the seller has only a right to start a prosecution in the criminal courts against the offender, and this course will not reimburse him for the value of the stolen goods. If the goods stolen are recovered, the judge at the trial can, if the offender is convicted, make an order for the restitution of the goods, and they will become the seller's property once more. But often the goods are not recovered, the offender having disposed of them elsewhere. In that case the judge can make an order compelling the prisoner to make payment out of any money found on him; but, of course, such offenders rarely have any money, and so the defrauded seller gets nothing. For the same reason it is hardly ever worth while to start civil proceedings against a person who commits a fraud of this kind.

But if a messenger who calls for goods produces some order or authority from the person who has ordered the goods on the telephone, and this person is known to the seller, then an action for the price of the goods can be taken against the person issuing the order, even though the messenger decamps with the goods. For if the buyer's own servant is dishonest this is not a liability of the seller. If, however, the order produced by the messenger is forged, then the seller is in as bad a position as before. A firm cannot be made liable for orders forged in its name, unless the firm had in some way connived at the forgery. On the other hand, if a dishonest servant, who has charge of the order book, issues orders for his own benefit, the firm whose order is used might be made liable on its order, since the order was issued by the firm's agent in the ordinary course of business. For these reasons it is the best, and indeed the only, course to ask for some credentials, preferably written, from any messenger who comes to collect goods. By the fact of part of the goods having been delivered, the contract is made legal and can be sued upon at law.

When orders are taken by commercial travellers similar rules apply. The seller may find that the buyer on delivery either refuses to accept the goods or denies that he ever ordered them. In such a case the only evidence that the seller has is the order written out by his own traveller, which is, of course, no evidence against the buyer. It is a wise practice to get the buyer to sign the traveller's order.

The Sale of Goods Act, under which the above rules are made, does not apply to Scotland. In Scotland *any* evidence, verbal or otherwise, is enough to prove a contract of sale. Hence a salesman taking an order in Scotland need not get a signature from the buyer, provided that there are witnesses who can prove the contract. Some contracts are made partly in England, and partly in Scotland. Thus a Scottish buyer may send an order to England which is to be executed in London. In such a case English law will apply. What is meant by execution in London depends on the terms of the contract. If the buyer asks that the goods shall be delivered to some agent of his, or asks for them to be put on rail, or sent to a certain carrier for transport, the delivery to the carrier will be deemed to be an execution of the order, and if the goods are lost in transit then the loss will fall on the buyer. But if the buyer merely orders goods to be delivered to him, the seller choosing his own mode of transport, the order will not be executed until the goods arrive at the buyer's premises, any loss in transit will fall on the seller, and, if the buyer is in Scotland, Scottish law will apply, since the contract was to be executed (by delivery) in Scotland. Where an order comes from Scotland by telephone similar considerations apply. It is the place where the order is to be executed which determines what law is to apply, and since verbal orders are good in Scotland for goods up to any value, the proof of the telephone order will be enough, the only trouble being, of course, that when a trader receives an order over the telephone he cannot tell where it comes from in actual fact. A telegram is a much more satisfactory mode of ordering goods quickly from a long distance. The original copy of the telegram, kept by the Post Office, will be evidence against the buyer, although even then, unless the telegram were written by some authorised agent of the buyer, it will be of little use in itself. The same applies to the signature obtained by a carrier on delivery. Delivery at the buyer's premises is good enough evidence on which to sue; but the fact of delivery must be proved, and if the signature was wrongly obtained, or is the signature of some person not in the employ of the buyer, it will be of little use.

Even the best devised systems and laws leave an opening for dishonesty, and traders dealing with unknown persons, or with known traders in an informal manner, should weigh up the risks involved on the one hand, by the refusal to execute the order, and on the other, the possibility of fraud.

Electricity for the Home.

Domestic electrical development at Walton-on-Thames; recently introduced manufacturers' items.

SITUATED between Surbiton and Weybridge, Walton-on-Thames is no longer a simple riverside village. Its woodlands and characteristic commons have been converted into a widely extending residential neighbourhood conveniently outside the outer fringe of suburban London. The Urban District Council, while encouraging post-war development of the district, did not overlook the fact that conditions governing the supply of electricity were not altogether satisfactory.

In the autumn of 1927 the public demand for a cheaper and more extended service of electricity culminated in the Council's decision to exercise its option to purchase outright the monopoly of the existing supply so far as it applied to the territory under its jurisdiction, and a large sum of money was authorised for expenditure on new works and a complete overhaul and reorganisation under the control of a newly appointed electrical engineer. Improvements in the supply and distribution of electrical energy were obtained by the building and equipment of two sub-stations and the division of the district into seven zones, with at least two transformers supplying each zone. These reforms were accompanied by the introduction of lower tariffs of 7½d. per unit for lighting, and 2d. per unit for heating; the latter charge was further reduced to 1½d. a few months ago. An immediate response has been made to these well-planned efforts to popularise electricity, approximately fourteen miles of new mains having been laid to provide new connections in all parts of the district. On the Council's housing estate of some 200 dwellings a strong demand by the tenants for a secondary means of heating and cooking was met by the inauguration last September of a local campaign in favour of electric cooking, coincident with the introduction by the Council Electricity Department of an attractive hire and hire-purchase scheme by which an electric cooker could be obtained and fixed at a figure well within the financial capacity of the middle and artisan class of householders. The cooker chosen as a standard after competitive tests for efficiency and simplicity of operation was the "Magnet Minor" manufactured by the GENERAL ELECTRIC CO., LTD. For the sum of 4s. per quarter one of these cookers and a "Magnet" 3-pint copper kettle, fitted with an automatic cut-out, is installed free, with up to 30 ft. of wiring, and with free maintenance, while for an extra 1s. per quarter a "Magnet" 5½-lb. iron may be added. The temporary showroom opened at 29, High Street, solely for the demonstration of cookers, has now been in operation for three months, and during that period 236 of the cookers have been supplied on hire or hire-purchase terms.

Fig. 1.—In One of the Larger Walton Flats.

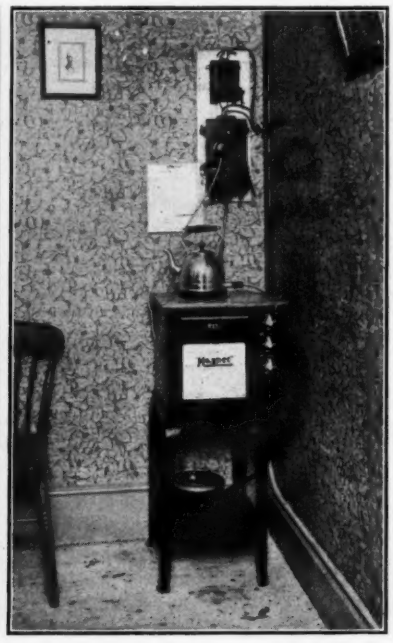


Fig. 2.—Cooking Equipment in a Two-room Flat.

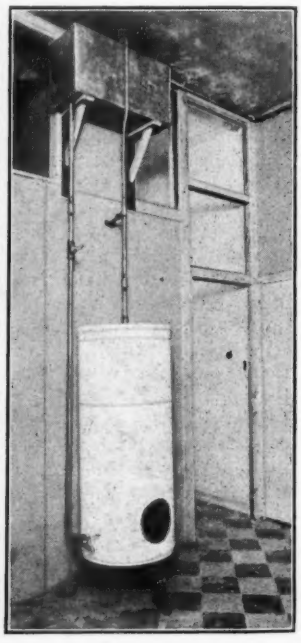


Fig. 3.—One of the Bathroom Group Water Heaters.

Enthusiasm for extending the benefits of electricity in the home to all classes of people has been practically demonstrated by the owner of a large hitherto unoccupied mansion, who is a member of the Electrical Association for Women and has had the building converted into residences comprising two six-roomed, four four-roomed, and seventeen two-roomed flats. All the flats have been extensively wired for the use of electricity, heating outlets being provided in every room. The larger flats have each been equipped with a G.E.C. cooker suitable for four or more persons, while the two-roomed flats are each fitted with a "Minor" cooker and a three-pint copper electric kettle with an automatic cut-out. Figs. 1 and 2 depict, respectively, the cooking apparatus in the larger and smaller flats. The convenience of the fortunate tenants of these flats is further provided for by an electrically heated hot-water system. The larger flats have their own bathrooms in which are installed "Magnet" water heaters, while the tenants of the two-roomed flats have the use of separate bathrooms which are grouped at each end of the corridors. Hot water for each group of bathrooms is supplied by means of 30-gallon "Magnet" storage water heaters, thermostatically controlled, fig. 3,

and the current used by these water heaters, of which there are three, together with that for corridor lighting throughout the building, is paid for by the owner. By a special arrangement made with the Walton Electricity Department the owner of the flats pays to the Council the fixed charge calculated to cover the requirements of the building as a whole, while the individual tenants purchase current as they use it through a slot meter at 1½d. a unit for all purposes in their own premises.

These interesting developments at Walton offer convincing evidence of the assimilation by a large section of its residents of the teaching of electrical propaganda and of their appreciation of the practical advantages to be gained in labour saving, cleanliness, and economy in the home, by the adoption of electrical methods of cooking and heating. The Council and its enterprising electrical engineer, Mr. E. A. Anderson, A.M.I.E.E., is to be congratulated on its initiative and courage in carrying through so successfully a campaign to popularise electricity, the results of which we have ascertained are proving mutually profitable to all parties concerned and show healthy signs of continued development.

It is sincerely to be hoped that this remarkable reaction to the provision of cheaper electricity will not pass unheeded by public authorities in other parts of the country.

New Electric Fires.

From the range of new electric fires recently introduced by Messrs. FALK, STADELMANN & CO., LTD., Efesca

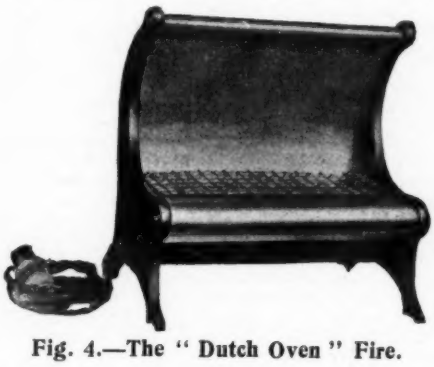


Fig. 4.—The " Dutch Oven " Fire.

Electrical Works, 83 to 93, Farringdon Road, E.C.1, we have selected the " Dutch Oven " model and the " Maisonette " model, figs. 4 and 5, respectively, as being of particular interest. The " Dutch Oven " fire

Fig. 5.—Falk, Stadelmann " Maisonette " Fire.

is supplied in two sizes—11 in. high by 11 in. wide by 7½ in. deep, with a loading of 750 W, and 14½ in. high by 16½ in. wide by 6½ in. deep with a loading of 1,500 W. The smaller size has cast-iron sides, a finish of crystalline black, a brass wire hinged guard, and a polished-copper concave reflector. The sides of the larger size can be finished in crystalline black or oxidised copper.

The " Maisonette " fire is claimed to be a very effective appliance, incorporating the utility of a hob on which water can be warmed and food kept hot. It is equipped with foot-operated switches. It is made in two sizes with 1.5- and 2.25-kW loadings, respectively. The smaller size has two element bars and 2-heat control. It measures 15½ in. by 13¾ in. by 9 in. deep. The large size, which has similar dimensions, is equipped with three element bars and 3-heat control. Antique-brass, oxidised-copper and armour-bright finishes can be supplied.

Fig. 6.— A" Redot " Fire.

A somewhat unusual design of electric fire is represented by the " Redot " fire illustrated in fig. 6. It is a solidly and soundly constructed 3-bar fire in oxidised-brass finish. The back of this fire is hinged to allow of easy access to the plug-in type elements with which it is fitted. The fire measures 20 in. high, 14¾ in. wide at the top, 22 in. at the base, and it has a maximum loading of 3 kW. It is fitted with two switches, allowing one, two or three elements to be in operation at any one time. The " Redot " fire is a product of LIGHTING TRADES, LTD., Oriel House, 30-31, Farringdon Street, E.C.4.

Electrically-warmed Blankets and Pads.

We are informed that the address of THERMEGA, LTD., to which we referred under the above heading in our last issue, is now 51-53, Victoria Street, S.W.1, and not 94, Petty France, as stated.

Oxide-Coated Filaments.

The electron current from a hot wire can be increased enormously in certain circumstances by coating it with the oxide of an alkaline earth metal. Some investigations on these filaments are described by J. A. Becker, of the Bell Telephone Laboratories, in the second November number of the *Physical Review*. It appears probable that high activity is associated with absorption of the alkaline earth metal at the surface, and that many of the changes which occur in the emission are brought about by electrolysis of metal or oxygen atoms through the oxide, the value of the filament as a source of electrons as with composite filaments of tungsten and thorium or cæsium, depending on the fraction of the surface covered by the active metal. The efficiency of the latter is reduced if it is covered with oxygen atoms, but is increased if it is free on the side facing towards the vacuum, but anchored by oxygen atoms to the main surface. By appropriate control of temperature and electron current, either the alkaline earth metal or the oxygen can be made to evaporate. The probable process of electrolysis in the oxide is described, and it seems that Ohm's law is not valid; most of the current is carried by electrons, and a relatively small part by ions.

The Electricity Commissioners' Work.

Extracts from their Ninth Annual Report, 1928-29.

(*Continued from page* 92.)

A possible source of difficulty in connection with the furtherance of bulk supply developments had reference to contracts for the taking of supplies in bulk by company undertakers (being authorised distributors) whose undertakings were liable to be purchased by the local authorities for the areas concerned; and the question was raised as to the position, after such purchase, of any contract which had been entered into by the company for a term of years extending beyond the date of purchase.

On a review of the circumstances obtaining at or about the date of purchase by the local authority of any undertaking dependent either wholly or in part upon a bulk supply, the following considerations would appear:—(i) There are no statutory provisions whereby it would be competent for the local authority, prior to the actual purchase of the undertaking, to enter into any arrangements for the provision of an alternative supply of electricity to be available immediately on the completion of the purchase. (ii) On becoming the authorised undertaker, there is an immediate statutory obligation upon the local authority to provide a regular and efficient supply. (iii) Before the new local authority undertaker could incur expenditure upon works for the provision of alternative supply, sanction to borrowing would be required; in connection with any application made on that behalf, it would fall to the local authority to satisfy the Commissioners that the contemplated works were necessary and suitable to the proper development of the undertaking. These considerations point to the conclusion that even in the event of there being no taking over, by assignment, of the then subsisting bulk supply contract, the continuance of the bulk supply is nevertheless likely to prove a *sin qua non* in actual practice. It is also difficult to envisage circumstances which would justify the subsequent supersession of existing bulk supply works in favour of other works for an alternative supply.

The question of the terms for the continuance of the bulk supply would remain for settlement in cases where there was no assignment of the bulk supply contract. In the course of the next few years the majority of the undertakers then giving or in a position to give bulk supplies will, in turn, be receiving their supplies of electricity directly or indirectly from the Central Board. If in the case of non-assignment the continued bulk supply to the purchased undertaking were received from such an undertaker, the position would appear to be automatically resolved by the provisions of section 12 of the Act of 1926, since the new local authority distributor could not be required to pay a price in excess of that prescribed by the section, while the undertaker from whom the supply was received could not be required to continue the supply at a price lsss than that prescribed by the section. The one outstanding matter in the event of the non-assignment of the bulk-supply contract would be the position of the displaced distributor in relation to the undertaker with whom the contract had been made. On this point, it is open to company undertakers in entering into contracts extending beyond the date of possible purchase of their undertakings, to consider the desirability of including suitable provisions for safeguarding their positions so far as is legally possible in the event of the right purchase being excercised.

Systems of Supply.

General approval was given to the adoption of 3-phase 50-cycle alternating current systems at pressures of 6,600 volts, 11,000 volts, 22,000 volts, 33,000 volts, 49,500 volts, 66,000 volts, or 132,000 volts. The Commissioners also approved of the adoption by three authorised undertakers of systems of supply which differed from the general standard, and issued consents to an alteration in the declared systems and/or pressure of the supply hitherto adopted by 23 different authorised undertakers.

Consumers' Apparatus.

In regard to the question of the liability of authorised undertakers in respect of consumers' apparatus affected adversely by a change of system and/or pressure, with particular reference to apparatus, such as wireless apparatus, which had been installed by consumers without the knowledge of the undertakers (Eighth Annual Report, pp. 63-65), the Commissioners in May, 1928, adopted a modified form of consent to the effect that where notice of its intention to carry out the necessary alteration to consumers' existing apparatus was served by the undertaker on any consumer not less than one month and not more than six months prior to the date fixed for the alteration, no liability should attach to the undertaker in respect of apparatus installed by the consumer after the service of such notice.

Earth Connections.

At the commencement of the year under review, the Commissioners had before them an application from the Central Electricity Board for general approval to multiple earthing of the "grid" system under the various regional schemes. As the outcome of experiments on multiple earthing on the North-East Coast system of supply, approval to multiple earthing had already been given in previous years by the Commissioners to six other undertakers, with the concurrence of the Postmaster-General. The Commissioners, with the concurrence of the Postmaster-General, approved of the Central Board connecting the neutral point of any electrically distinct high-voltage circuit with earth at more than one point, subject to the conditions that: (i) Earthing at more than one point should not be made on a circuit connected with a generator whose neutral point was earthed. (ii) All points at which the neutral was earthed should be formed by transformers with windings so arranged as to minimise any residual voltage to earth. (iii) The Board should at its own expense take all necessary steps to eliminate any injurious effect caused by such earthing to plant belonging to the Postmaster-General, and should not bring any such earthing into use on any section of any circuit until a test under normal operating conditions had been made and the Postmaster-General had been satisfied after being given reasonable notice of the test, that such earthing did not injuriously affect his plant.

Regulations.

A new code of Overhead Line Regulations was made by the Commissioners with effect as from 16th April, 1928. At the same time, a revised Memorandum of Procedure in respect of applications by the consent of the Minister of Transport to the erection of overhead lines was adopted with the concurrence of the Minister.

At the commencement of the year, the Commissioners had under consideration a preliminary draft of a proposed consolidated Code of Regulations for ensuring a proper and sufficient supply of electrical energy, and for securing the safety of the public. The draft was based, in the main, upon suggestions submitted by a Special Committee of the Institution of Electrical Engineers which had been appointed on the invitation of the Commissioners. The Commissioners also had regard to representations which had been made to them from time to time by the Home Office, and by other bodies, such as the London County Council, on particular aspects of electricity supply. The opportunity was taken of discarding such of the provisions in the prior codes (drawn up in the pre-war period) as had been rendered obsolete or unnecessary by reason of subsequent advances in technical practice; and also of making provision for other matters which had only assumed prominence in recent years as a result of the expansion of the electricity supply industry. At the date to which this Report was made, the Commissioners had practically concluded their consideration of the matter.

In the course of revising their Overhead Line Regulations, the Commissioners made further representations to the Postmaster-General on two matters which had been raised by the electricty supply industry on previous occasions, namely, the question of the relaxation of his requirements as to protection between Post Office lines and electricity supply lines, and the question of defrayment of the cost of protection in cases where the Post Office was the second-comer. On the first question, the Postmaster-General was prepared to modify the Post Office requirements in a number of respects, as indicated in the explanatory memorandum issued by the Commissioners with their revised code of Overhead Line Regulations in April, 1928. With regard to the other question, the Postmaster-General subsequently intimated that he was prepared, as a final settlement, to bear the whole cost of providing guarding or alternative protection when the Post Office was the second-comer, provided that the following conditions were satisfied:—(i) the undertakers' legal obligations remained as at present; (ii) the Post Office would only bear the cost of guarding, (*a*) if satisfied that protection was necessary, and (*b*) on condition that where alteration to the power line was desired, the undertakers would, before carrying out such alteration, meet the Post Office in adopting the

most appropriate methods of dealing with the particular circumstances of each case, and would furnish such estimates as would enable the Post Office to determine the course to adopt; and (iii) the maintenance of any protective fixtures forming part of their systems remained the responsibility of the undertakers.

It was made clear that the position with regard to the second-comer would have to be reviewed if the undertaker's legal obligations were altered in any way in the future.

The Commissioners served notices and prescribed regulations for securing the safety of the public and for the protection of the electric lines and works of the Postmaster-General in 88 cases where electric lines and works had been erected or laid down without statutory authority. During the previous eight years, the Commissioners dealt, on an average, with about 34 such cases per annum. The increase in 1928-29 was due to the steps taken by the Commissioners at the end of the previous year to obtain a more complete official record of electric lines and works constructed without statutory authority. The particulars disclosed the existence of non-statutory electricity undertakings, and also of installations of electric lines and works of some magnitude owned by colliery companies and similar bodies. In the nine largest cases of the latter kind, the installations comprised in aggregate about 21 miles of electric lines, for the transmission of electrical energy at pressures ranging up to 12,000 volts.

(To be concluded.)

Business and Industrial Notes.

The Week's Electrical Trade News from all Sources. Commercial and Industrial Developments, Business Changes, Market Prices for Materials, Trade Openings, New Publicity Literature, Liquidations, and Failures.

Hackney Prefers British Plant.

At its last meeting, the Hackney Electricity Committee considered, among other matters, tenders for a 30,000-kW turbo-alternator and accessories. A list of the companies who put in tenders, and their prices, is given in our "Contracts Closed" section. The lowest price was that of the A.E.G. Electric Co., Ltd., for plant of German manufacture. In commenting on this, the Committee stated that, although the A.E.G. was a company of high standing and had built a large number of turbines, there was none of the size in question of A.E.G. make in this country. "The specification called for a set of generating plant of the highest efficiency, but in this particular the machine put forward by the A.E.G. Company would not reach the ordinary 'standard' machine of British manufacture." It was also considered doubtful whether the economy of the foreign set would be equal to that of the "standard" sets offered by Messrs. C. A. Parsons & Co., Ltd., and the English Electric Co., Ltd. Figures of steam consumption had been supplied in each case, but it was considered that there was some doubt as to the basis on which the figures for the foreign turbine had been calculated. Other points which were considered were the delay which must occur in effecting repairs in case of emergency, and allied questions. Therefore, after reviewing the British tenders for high-efficiency machines, the Committee recommended the Council to accept the offer of Messrs. C. A. Parsons & Co., Ltd. The matter was to come before the Council on Wednesday evening last.

The Canadian Electrical Market.

Mr. John Belliss (of Belliss & Morcom, Ltd.), senior vice-president of the Birmingham Chamber of Commerce, has recently returned from a three-months' trade visit in Canada. It is, he says, probably in the electrical industry that American influence is most felt in Canada. The two big American companies—the General Electric Co., of New York, and the Westinghouse Co., of Pittsburgh, have established a large manufacturing works there. He was glad to find, however, that four or five of the British electrical firms were doing quite satisfactory business in the Dominion, and that their sales were continually increasing. There is also at least one Continental firm that is quite pleased with the progress which it is able to make in the same market. At the Canadian National Exhibition at Toronto some British firms were represented in the engineering and electrical section. Everything should be done to foster the "Come-to-Britain" movement.

Conditions in the United States.

According to Mr. W. Green, the president of the American Federation of Labour, there are at present about three million persons temporarily or permanently unemployed in the United States. The *Financial News*, commenting on conditions in the United States, says that many contradictory statements have been made regarding the immediate future. It would appear, however, that while few people expect any deterioration of business and financial conditions, it is not anticipated that business, investment, and finance will be restored to the early 1929 level this year. Some industries, such as the automobile and building industries, are admitted to be facing rather serious problems. On the whole, farmers are doing better; the railways have suffered a reduction of traffic, but expect to recover as business improves. Export trade fell off seriously in November, and it is thought that a further decline was experienced in December.

Finance and Industry.

Speaking at a luncheon in Manchester on January 10th, Mr. J. H. Thomas, Lord Privy Seal, made a review of the present state of industry with reference to his plans for dealing with unemployment. He said that he had consulted many leaders of industry and Trade Unions; each had his remedy for the existing conditions, but they were not unanimous. Some wanted more Government assistance and some deprecated Government interference. Public money could not be poured out unless there was an adequate return for it: if it was so spent as to equip industry better for competition in the markets of the world. We had to get customers for the goods which we made. At home we could stimulate trade by developing docks, railways, and harbours and providing a cheap electricity supply, but the question of export trade required greater consideration. Business interests must not rely too much on the Government in this direction, although the Government would do what it could in the way of political and commercial diplomacy. It was the intention to revive some of the abandoned commercial diplomatic posts: appointments would shortly be made to Colombia, Switzerland, Brazil, Argentina, and Persia, and new posts would be established in Finland, Egypt, China, Canada, South and East Africa, and the West Indies. There would also be further economic missions similar to the recent one led by Lord D'Abernon.

It had been said that the banks were indifferent to the needs of industry and actually hampered trade. He considered that that criticism was ill-founded: the banks were perfectly willing to assist industry if industry would take steps to reorganise and re-equip itself. The banks had expressed their willingness to make advances to any industry or industries which produced schemes which offered reasonable promise of enabling those industries to become effective units in combination and co-operation with other similar undertakings.

Rural Electrification in Australia.

Steps are being taken by the State Electricity Commission of Victoria to develop more aggressively the farm load, and as a result of its initial activities numerous inquiries are being received in connection with electrically-operated farm equipment. The Commission wishes to be in a position to furnish full information to its consumers on the prices, energy consumption, and the source of supply of all types of farm electrical devices and particularly the following:—Incubators and brooders; egg-cleaning apparatus; milking plants; separators; dairy water heaters; water systems; milk coolers; refrigerators; pasteurisers; portable motors—single-phase, 460 V fractional h.p., 230 V, with integral reduction gear, variable speed, single-phase; lawn mowers; and greenhouse heating equipment. Also all classes of farm machinery, such as chaffcutters, food crushers, &c., in which electric motor drive is integral with the plant. The Commission therefore invites manufacturers of any of the above equipment to communicate with it, stating particularly the following:—(a) The name and address of their representative in

Australia, if any. (*b*) If not represented, the terms on which they will ship sample equipment. (*c*) The price, weight, and cubic measurement packed, and whether wholly manufactured in Great Britain. (*d*) The output, wattage, and energy consumption of appliances. Also complete descriptive and illustrated matter which will enable it or its clients to order, appliances if required. A large electrical exhibition will be held in Melbourne in September next, and the Commission desires to introduce some of the latest farm electrical appliances on that occasion.

Unemployment.

An increase of 206,643 in the number of registered unemployed was recorded during the fortnight ended December 30th. On that date the total was 1,510,200, as compared with 1,303,557 on December 16th, and 1,520,730 on December 31st, 1928. It is estimated that on December 16th there were approximately 10,159,200 insured persons in employment, which was 13,800 fewer than a month before, but 100,300 more than a year before.

Wheatstone's Concertina.

Mr. E. Kilburn Scott reminds us that last year was the centenary of Sir Charles Wheatstone's invention of the English concertina. Sir Charles's work in connection with telegraphy has rather overshadowed his contribution to music.

Indian Economic Progress.

Sir Basil Blackett, on January 10th, read a paper before the Royal Society of Arts on "The Economic Progress of India." According to *The Times*, the author said that if India were in a stage of development comparable to that of the nations of Europe or the United States of America, her vast unhampered home market in a land enjoying extraordinary climatic and geographical variations could not fail to place her in the forefront of economic wealth. During the last 30 years the development of Indian industries had been deliberately and actively fostered by the Indian Government. The economic interests of this country and of the Empire were in no way divergent from those of India. The more prosperous and progressive India became, the better for this country, both as a great trading nation and as the political centre of a great empire. The next few decades would in all probability see the rapid growth of a small number of large economic units; and there was no need to picture them as mutually hostile and antagonistic. Without India the idea of a great Imperial economic unit suffered a grievous shrinking. India was still obsessed with doubts as to her status in the Empire, and for this reason had no mind at present to turn her attention to questions of Imperial economics. Britain had solved many Imperial constitutional questions in the past by loyal adherence to the guiding principle of individual freedom and free institutions.

Radio Week Campaign.

For the first time in the history of radio in this country, the B.B.C. has joined forces with the trade in providing a week's programme of popular entertainment, and is seeking to show the fine programmes it could and would provide if there were five million set-owners instead of three million. Radio Week, which commenced last Sunday, has been timed to come exactly midway in the history of public broadcasting in this country, which started on November 17th, 1922, and which, in its present form is now beginning its second seven years, at the end of which time the B.B.C. charter will expire. Radio traders are spending many thousands of pounds in advertising radio to the nation. Millions of posters are being exhibited all over the country, and the gramophone companies are sending out decorated vans and, bills giving the B.B.C. programme for the week have been posted in practically every town and village of the country.

The General Electric Co., Ltd., is identifying itself with the campaign, and the windows of the head office in Kingsway, and at the twenty-three branch establishments throughout the country, have attractive displays of a representative range of the radio products of the company.

Recent Contracts.

In addition to the orders received during 1929 by the ENGLISH ELECTRIC CO., LTD., mentioned in our last issue (p. 66), the company has just received confirmation of two important Canadian contracts. The first is for an 18,000-h.p. double-overhung impulse turbine and 15,000-kVA, 6,600-V, 60-cycle alternator, the speed of the unit being 300 r.p.m. and the effective head 1,010 ft. The set will be designed for an overspeed of 555 r.p.m., and is complete with two main valves of the company's cylindrical balanced type, and a 250-kW auxiliary motor-generator set. The two runner wheels are overhung on the two ends of the extended generator shaft, the general arrangement being somewhat similar to that adopted for the units supplied by the company for the Bhira power house of the Tata Power Co. The unit has been ordered by the Vancouver Island Power Co. through the English Electric Co. of Canada and will be installed in a power station on the Jordan River, British Columbia. The other order is for a 6,000-kVA, 6,600-V, 60-cycle, 450 r.p.m. vertical-shaft generator for water turbine drive for the Power Corporation of Canada for installation at its Falls River power station near Prince Rupert, B.C. This machine has a direct-coupled exciter and is designed for an overspeed of 900 r.p.m.

SPHINX ELECTRIC, LTD., has received a further contract from the G.P.O. for the supply of "Quickfix" electrical fittings.

What is claimed to be the largest industrial transformer order ever placed in this country has been obtained by the HACKBRIDGE ELECTRIC CONSTRUCTION CO., LTD. The contract covers twenty-five transformers operating at 154,000 V. The transformers have been ordered by the Northern Aluminium Co., Ltd., and the value of the order is nearly £150,000. Tenders were invited from the leading Canadian and European manufacturers.

Book Notices.

"The Colliery Manager's Pocket Book, 1930." Pp. xxxii +456+71. Edited by J. Vincent Elsden, D.Sc.(Lond.), F.G.S., and Hubrt Greenwell, F.S.S., Assoc.M.I.E.E. London: The Colliery Guardian Co., Ltd.—This sixty-first edition of this valuable work maintains its high standard of the past, and the necessary revision has been effected to bring it up-to-date.

"*Mechanical World* Year Book, 1930." Pp. 180; illustrated. London: Emmott & Co., Ltd. Price 1s. 6d. net. In accordance with the usual practice, several improvements have been made and new sections added to this 43rd edition. The sections on steam engines, steam turbines, condensers, and rope driving have been carefully revised and rewritten.

"Starkstromtechnik," by E. v. Rzcha and J. Seidener. Pp. xix+1,039; illustrated. Berlin: W. Ernst und Sohn. Price 34 Rm.

"The Post Office Electrical Engineers' *Journal*." Vol. XXII. Part 4. January, 1930. London: Electrical Review, Ltd. Price 1s. 3d. net.

Local Exhibition.

MOTHERWELL.—An electrical exhibition organised by Mr. W. D. Brassington, borough electrical engineer, and his staff, was held at the Y.M.C.A. Institute during the annual carnival from December 27th to January 4th. Among the manufcturers displaying their products were the Credenda Conduits Co., Ltd., General Electric Co., Ltd., Quain Sunlight Lamps, Ltd., J.P. Tubular Heating Co., Siemens Electric Lamps & Supplies, Ltd., Edison Swan Electric Co., Ltd., L. G. Hawkins & Co., Ltd., Santon, Ltd., Electrolux, Ltd., and Hoover, Ltd. The E.L.M.A. display included an exhibit of model room, shop, and workshop interiors showing correct and incorrect lighting, whilst a selection of E.D.A. posters attracted considerable attention.

The Transport of Heavy Plant.

To meet the latest requirements in respect of the railway transport of heavy and out-sized consignments, and having in mind contemplated developments with regard to electrical plant, the Great Western Railway Co. is building a new type of wagon with demountable side girders, interchangeable with the well centre, capable of carrying loads up to 120 tons.

An Arc-Welding Hire Service.

Engineering firms which may only require arc welding plant for a particular job, or are uncertain as to whether arc welding will be of benefit in their particular case, will be interested in a hire system which has been inaugurated by Alloy Welding Processes, Ltd., Ferry Lane Works, Forest Road, E.17. Under this scheme any type of welding plant can be hired at small monthly rentals. Such plant is maintained in an efficient state, and skilled demonstrators call from time to time to ensure efficient working and to advise the hirer regarding the best methods and type of material to be used for various classes of work.

A German-American Bosch Agreement.

All litigation between the American Bosch Magneto Corporation, the Robert Bosch Magneto Co., Inc., and the Robert Bosch interests in Germany has been settled by agreement. This ends ten years of litigation and controversy between the companies, mainly due to the seizure of the Bosch interests in the United States during the war. Under the settlement the American Bosch Magneto Corporation is to have the sole right to the use of the single word "Bosch" in connection with the production and sale of motor components, radio, and all its other products in the United States, Canada, Mexico, Cuba, and the American dependencies. The Robert Bosch interests will have the right to use the words "Robert Bosch" in the same territory. In other countries the Robert Bosch interests have the sole right to the use of the single word "Bosch," and the American Bosch Magneto Corporation is to have the right to use the words "American Bosch" in such territory. The arrangement as to the use of the word "Bosch" is to continue in force for a period of 49 years.

Calendars and Diaries.

Messrs. CROMPTON PARKINSON, LTD., Bush House, Aldwych, W.C.2, state that they will be pleased to send a 1930 refill for their desk diaries to any of our readers who have not yet received one.

Wishing us a prosperous New Year, the IMPERIAL LIGHTING Co., 2, Pocock Street, S.E.1, sends us a pack of playing cards.

The calendar for 1930 sent by W. H. WILLCOX & Co., LTD., 38 Southwark Street, S.E.1, takes the form of monthly sheets with illustrations of the company's belting, hose, oils, &c.

The Organisation of Exhibitions.

A report recently issued by the British Electrical Development Association (Report No. E.D.A. 802), on two successful local exhibitions held in the Midlands, contains much of interest to those who contemplate organising local electrical exhibitions. The report is divided into two sections, the first dealing with an exhibition containing displays arranged by manufacturers, and the second with an exhibition arranged entirely by the local electricity undertaking with the assistance of the local electrical contractors. Useful information is given in the report as to the various methods of publicity employed in each case, the arrangement of stands, and attractions, such as cooking demonstrations, lectures, &c., employed during the run of the exhibitions. Records of daily attendances are also given, together with exhibition costs. The report points out that the attendance at every local exhibition depends almost entirely on the amount and character of the publicity employed in advance and during the period of the exhibition, and that the E.D.A. is prepared to assist in the preparation of publicity schemes to suit local conditions.

New Belgian Company.

The Société Belge de Traction Electrique par Accumulateurs, S.A., of Brussels, has been formed with a capital of 1,750,000 fr. for the purpose of promoting transport of any kind by means of accumulators. The promoters are the Société Continentale de l'Accumulateur Edison of Saint Josse, the Société Accumulateurs Tudor, S.A. of Saint-Gilles, the Ateliers de Constructions Electriques de Charleroi, the Société Intercommunale Belge de d'Electricité, and M. Emile Uytborek, of Etterbeek, all of whom combined have subscribed one half of the capital.

Our Overseas Electrical Trade.

The following were the values of imports and exports of electrical goods and machinery from this country during December :—

	Dec., 1929.	Inc. or dec. compared with Dec., 1928.	12 months, 1929. Inc. or dec.
	£	£	£
Imports.			
Electrical goods and apparatus	720,088	+252,596	+1,795,362
Machinery	1,629,491	+394,826	+2,400,096
(Including electrical machinery)	191,455	+ 41,082	+ 162,500
Exports.			
Electrical goods and apparatus	1,173,163	+251,299	+1,548,155
Machinery	4,408,195	− 91,409	+ 637,147
(Including electrical machinery)	537,917	+ 24,143	− 334,844
Re-exports.			
Electrical goods and apparatus	19,894	+ 6,178	+ 52,390
Machinery	130,920	− 10,664	− 5,148
(Including electrical machinery)	12,160	+ 3,563	− 17,868

For Sale.

Salford Corporation Electricity Department invites offers for the purchase of four Weir centrifugal feed pumps, two motor-driven reciprocating feed pumps, and one steam driven air compressor. Norwich Corporation has for sale 3½-ton Garrett electric tipping refuse collecting vehicles. Hull Corporation Electricity Department invite offers for the purchase and removal of surplus plant at its power station. (See our advertisement pages to-day.)

German Foreign Electrical Trade.

The imports of electrical machinery and apparatus into Germany during the ten months ended with October last attained a value of £2,174,850, as compared with £1,800,150 in the corresponding ten months of 1928. On the other hand the exports of similar material from Germany advanced from £19,975,600 to £23,761,000.

Polish Insulating Tube Syndicate.

A syndicate of manufacturers of insulating tubes has recently been formed in Warsaw for a period of five years, comprising the following works: The Cable Company, of Krakau, the Patzer Electrotechnical Works, of Warsaw, the Upper Silesian Insulating Tube Company, of Kattowitz, and the Stamrey Insulating Tube Company, of Warsaw. A joint sales office is being established in Warsaw, which will attend to the business both in the home market and for export.

The Central Board's Activities.

The Times reports that Alderman William Walker, member of the Central Electricity Board and chairman of the Manchester Corporation Electricity Committee, speaking at Manchester on January 8th, said that the Central Electricity Board had already placed orders with British firms to the value of £10,600,000, and additional orders were about to be placed. A new scheme would be ready in a week for South-West Wales. (The scheme is dealt with elsewhere in this issue.)

The F.B.I. and Penny Postage.

Last week the Federation of British Industries again urged upon the Postmaster-General the desirability of restoring the penny post. It is pointed out that January 10th was the 90th anniversary of the institution of penny postage in this country.

Electricians' Demand for Higher Wages.

The London District Committee of the Electrical Trades Union recently put forward a claim for an advance from 1s. 10½d. to 2s. per hour in the wages of its members employed in the electrical contracting industry. The National Federated Electrical Association declined to concede this demand, stating that already the rates paid to these men are higher than those in any other section of the engineering and building industries. The Union has announced its intention to continue to press its claim.

Irish Free Trade Electrical Imports.

The trade returns for the first 11 months of 1929, issued last week by the Ministry for Industry and Commerce, Dublin, show that the value of the electrical goods imported into the Irish Free State during that period was £568,855, as compared with £483,247 for the first 11 months of 1928.

Bankruptcy Proceedings.

E. E. PEACE, trading as Peace & Co., 230, High Street, Erdington, Birmingham, manufacturing electrical engineer.—Bad trade loss on experimental work, and bad debts were the causes of failure put forward by this debtor, when he appeared at the Court House, Corporation Street, Birmingham, on January 8th for his public examination. His statement of affairs showed ranking liabilities of £1,090 and assets estimated to produce £161, leaving a deficiency of £929. In 1923 he entered into a partnership with an electrical engineer, but they were not successful, and in January, 1926, a composition of 10s. in the £ was paid to creditors, whose claims amounted to £235. The money to pay the composition was advanced by debtor's sister-in-law, and the partner withdrew from the business upon receipt of £5. The debtor continued trading, but he was not successful, and it was only by borrowing from relatives, and incurring an overdraft at the bank, that he had carried on. The examination was provisionally closed.

J. J. BROWN, Handysides Arcade, Newcastle-upon-Tyne, wireless agent.—The public examination of this debtor was held on January 8th at the Court House, 56, Westgate Road, Newcastle-upon-Tyne, when a statement of affairs was filed showing a deficiency of £326. The debtor attributed his failure to lack of capital. After he had been questioned the hearing was adjourned.

F. W. C. HOEY, wireless and electrical dealer, 51, Montgomery Road, Chiswick.—Receiving order made January 7th on debtor's own petition. First meeting, January 20th; public examination, February 28th, both at Carey Street, W.C.

J. CROOK (W. & J. Crook), wireless engineer, 5, Crosby Street, Atherton.—Receiving order made January 6th on debtor's own petition.

J. P. HAYES ("Evening World" Gram Stores & Service), radio electrician, 17, Lawrence Hill, Bristol.—Receiving order made January 2nd on debtor's own petition.

W. WORSNIP, wireless dealer, 36, Market Hall Walham Green, S.W.—Application for discharge to be heard at Carey Street, W.C., on January 28th.

Company Liquidations.

FELLOWS MANUFACTURING CO., LTD., Cumberland Avenue, Park Royal, and elsewhere.—The first meetings of the creditors and shareholders of this company were held on January 9th at Carey Street, W.C. The company's registered office was at the above address, and there were branches at 2, Princes Street, N.W., Birmingham, Bristol, Brighton, Cardiff, Glasgow, Liverpool, Leeds, Manchester, Nottingham, Newcastle-on-Tyne, Portsmouth, and Sheffield.

Mr. J. Barwick Thompson, Official Receiver, reported that the company was registered as a public company on July 25th, 1927, with a nominal capital of £175,000. The principal object of the formation was to acquire the business of the Fellows Magneto Co., Ltd., under a scheme of reconstruction, and the general objects were to carry on business as manufacturers and vendors of wireless apparatus, motor electricians, and ignition specialists. The magneto company had carried on business since 1916, but owing to the cessation of war contracts soon after the Armistice the business was seriously affected. Under the scheme of reconstruction dated July 26th, 1927, the whole of the undertaking of the Magneto Company was acquired by this company, subject to existing debentures, for £58,000. This company undertook to discharge all the liabilities including those debentures, and to allot to the shareholders of the old company 189,940 preferred ordinary shares of 10s. each credited as paid to the extent of 7s. per share (£66,479), and 253,644 deferred shares of 2s. 6d. each credited with 6d. per share (£6,341). The nominal value of the consideration payable in that manner was £72,820, and it was anticipated that the cash payable on those shares would provide approximately £53,855 to be utilised as working

capital. The issued capital of the company was £128,248. Further money was required, and in September, 1927, an arrangement was made to raise a loan of £68,000 with which to pay off the old company's debentures of £58,000 and to provide £10,000 for working capital. This loan was secured by the issue of 6 per cent. debentures for £68,000; at the date of the winding-up order the balance outstanding was £43,500. The company's business consisted chiefly of the manufacture of radio apparatus, which was sold direct to the public, usually under the hire-purchase system. The balance-sheet for the first 17 months of the company's existence showed a gross profit of £109,343, nearly one half of which was expended on advertising, and a net profit of £15,700. The result of the subsequent trading had not yet been ascertained, but it was clear that losses had been sustained. Early in 1929 the company was in need of further working capital, and the chairman advanced sums of money from time to time. Advances were also obtained from other sources. Altogether £15,200 was received and expended in the discharge of pressing liabilities, and was secured by the issue of 7 per cent. second debentures in November, 1929. As that was within six months of the commencement of the winding-up proceedings, it would have to be ascertained whether those bonds constituted a valid charge. Creditors began to press in August, 1929, and on November 29th, 1929, several judgments had been obtained, followed by executions. Mr. P. A. Bristow, C.A., was appointed receiver on behalf of the debenture holders. A petition to wind up the company was presented and a compulsory order was made on December 9th, 1929. A draft statement of affairs had been lodged, showing total liabilities of £107,290, of which £46,336 was unsecured, and assets of £61.612, which would be absorbed in the debenture and preferential claims. The deficiency with regard to contributories was estimated at £173,926. Proofs of debt amounting to £53,830 had already been received, as against the £46,336 returned as the amount of the company's unsecured indebtedness, and it was clear that no dividend could possibly be paid to the unsecured creditors unless the second debentures were to be set aside, in which event there might be a small dividend available. The failure of the company was attributed by the directors to (1) insufficiency of working capital; (2) the mistaken policy on the part of the directors in dealing directly with the public, which policy necessitated the expenditure of large sums on advertising and antagonised a section of the trade against the company's products; (3) unfavourable results produced by the hire-purchase system under which the company sold its goods; and (4) mismanagement on the part of a former managing director. The liquidation was left in the hands of the Official Receiver.

IDEAL WIRELESS CO., LTD., Dorland House, Regent Street, W.—Under a compulsory winding up order made on December 9th against this company, upon the petition of a creditor, the statutory first meetings of the creditors and shareholders were held on January 9th at Carey Street, W.C. Mr. G. Digby Pepys, Senior Official Receiver, reported that the company was registered on May 24th, 1929, with a nominal capital of £6,000 to carry on business as manufacturers of, and dealers in radio apparatus and gramophones. The issued capital was £1,002 in preference shares subscribed for cash, and on those shares £500 was due in respect of unpaid calls. The statement of affairs showed liabilities of £980, against assets estimated to produce £835, but these figures would need amendment. The failure of the company was attributed by two directors, Messrs. Black and Jones, to the non-receipt of promised capital, thus making it impossible to carry out a proposed advertising campaign or to pay for wireless sets as they were delivered. The Official Receiver considered that the failure was largely due to mismanagement, and he would have thought that very little capital, except at the beginning, would have been necessary, as the company neither manufactured nor distributed the goods, but merely acted as a sort of buffer between the manufacturers and distributors. A resolution was passed for Mr. H. J. Eldridge, 133, Moorgate, E.C., to act as liquidator.

FREEZONE, LTD., electrical refrigerator manufacturers, 839, Harrow Road, Willesden Junction, N.W.—A meeting of creditors was held on January 3rd at the offices of Messrs. Barton, Mayhew & Co., Alderman's House, Alderman's Walk, Bishopsgate, E.C.2, when it was reported that the liabilities amounted to £7,516, and the assets, after allowing for the mortgage on the premises and for preferential claims, were £4,512. It was stated that the present position had been brought about by lack of capital, and for some time past the company had been endeavouring to obtain liquid resources. Negotiations were pending for a possible offer for the business as a going concern, and if expectations were realised, there would be 20s. in the £ for the creditors. Unfortunately, the matter could not be decided until the beginning of February, and the directors had adjourned the shareholders' meeting in order that the creditors could consider the position. The product of the company was well known, but owing to a lack of money it had been impossible to carry out an advertising campaign. It was decided that the meeting should be adjourned for six weeks to await the result of the negotiations.

TRIOTONE, LTD., 41, Wigmore Street, W., and Factory Grove, Tottenham.—The first meeting of the creditors and shareholders of this company were held on Monday at the Board of Trade Offices, Carey Street, W.C., before Mr. G. Digby Pepys, Senior Official Receiver. A statement of affairs was presented showing liabalities of £7,226 against assets of £651, and a deficiency of £11,825, with regard to contributories, the issued capital being £5,250. The chairman reported that the concern was registered as a private company in July, 1928, to carry on the business of manufacturers of and dealers in "Triotone" gramophones and radio apparatus, carried on by Mr. Maryon Heiger at the above address. The vendor financed the company throughout and was a creditor for £696. The goods produced were in the nature of experimental work, the intention being to form a public company at a later stage. The trading resulted in a gross loss of £837, and possession of the assets had been taken on behalf of the holder of a debenture bond for £700. The failure of the company was attributed to insufficient capital and to the fact that the negotiations for the formation of a public company to acquire the assets were abortive.

Mr. Alfred Baker (Kenneth Brown, Baker, Baker) appeared on behalf of the directors, and in the absence of any resolution the Official Receiver remains in charge of the liquidation.

ALDERLEY & WILMSLOW ELECTRIC SUPPLY, LTD.—Winding up voluntarily. Liquidator, Mr. H. Fraser.

TALGARTH ELECTRIC SUPPLY CO., LTD.—Particulars of claims by January 31st to the liquidator, Mr. H. Ashton, Victoria Hall, Llandrindod Wells.

BUILTH WELLS ELECTRIC SUPPLY CO., LTD.—Particulars of claims by January 31st to the liquidator, Mr. H. Ashton, Victoria Hall, Llandrindod Wells.

YORKSHIRE ELECTRIC WIRING & MOTOR CO., LTD.—A meeting of members is called for February 20th, at the offices of Messrs. Phillips & Co., 39, Bank Street, Sheffield, to hear an account of the winding up from the Liquidator, Mr. W Neal.

NEW WILSON ELECTRICAL MANUFACTURING CO., LTD.—A meeting of members is called for February 10th, at 25, Finsbury Square, E.C., to hear an account of the winding up from the liquidator, Mr. R. Y. Richard.

UNIVERSAL ACCUMULATORS, LTD.—Winding up voluntarily. Liquidator, Mr. C. A. Frith, Adelaide House, King William Street, E.C.4. Particulars of claims by January 31st.

Winding-up Petition.

SYMPHONY GRAMOPHONE & RADIO CO., LTD.—A petition for the winding up of the above-named company has been presented to the High Court by Plessey Co., Ltd., electrical engineers and manufacturers, Vicarage Lane, Ilford, and will be heard in London on January 20th.

The *Financial Times* reported, on January 14th, that an arrangement had been made with the majority of the creditors and that the Judge will be asked to make no order.

Dissolutions of Partnership.

LEWIN & MURRAY, electric light, heat and power engineers, 3, Lord Street, Halifax.—Mr. A. Lewin and J. T. Murray have dissolved partnership. Mr. Lewin will attend to debts and continue the business under the style of A. Lewin & Co., Ltd.

MOUNTAIN, WOOD & MACLEAN, electrical and mechanical engineers, Sun Buildings, Newcastle-on-Tyne.—Mr. K. A. Mountain, Mr. W. W. Wood and Mr. A. B. MacLean have dissolved partnership. Messrs. Mountain and Wood will attend to debts and continue the business under the former style of W. C. Mountain, Son, & Wood.

BLACKBURNE & PARKER, radio engineers, 20, Southsea Road, Kingston-on-Thames, and 46b, Victoria Road, Surbiton.—Mr. R. G. M. Blackburne and Mr. W. M. Parker have dissolved partnership. Mr. Blackburne will attend to debts and continue the business.

Trade Announcements.

A fusion of manufacturing interests has been arranged between the RELAY AUTOMATIC TELEPHONE CO., LTD., and the STERLING TELEPHONE & ELECTRIC CO., LTD. The manufacturing facilities at Relay House, Streatham Hill, will be augmented to deal with the dual output of these two companies, which will manufacture automatic telephone apparatus and manual telephone apparatus, respectively. All inquiries in connection with the Sterling company's products should now be addressed to: Relay House, Streatham Hill, S.W.2.

Messrs. Nutter, Son & Edge, Cromford Court, Manchester, by arrangement, have ceased to represent the FOSTER ENGINEERING CO., LTD., Wimbledon, S.W.19, in the Manchester area. New premises have been taken by the Foster Engineering Co., at 13, Albert Place, Bridge Street, Manchester, and Mr. F. Harrison, late of the British Thomson-Houston Co., Ltd., will act in the future as branch manager.

Social Events.

The annual dinner of the staff of the Osram-G.E.C. Lamp and Glass Works and M.O. Valve Works was held at the Holborn Restaurant on Friday last week. There was a large gathering, including numerous ladies, and under the chairmanship of Mr. Christopher Wilson the evening was a most enjoyable one. After the loyal toast, Mr. G. Freeman proposed "The G.E.C." Referring to the phonomenal growth of the company, the speaker recalled that at the first staff dinner there were 50 present, including visitors; that evening the party numbered about 470. The directors had given their closest attention to the business and to the welfare of the employés, and they had erected a wonderful memorial to their work. He compared the research activities in the time of Robertson with the pre-

sent-day Wembley Laboratories to demonstrate the progress which had been made.

Mr. J. Y. Fletcher, responding for the company, expressed his regret at the absence of Sir Hugo Hirst on account of ill-health, but said that he was now doing well—and so was his horse which was to run in the Derby. Last year in respect of both lamps and valves the results had been exceptionally good, and that progress had also been enjoyed by practically all branches of the company. He enumerated some of the more important contracts secured during the year. He attributed the company's success to the good relationship existing between the works and the sales staff. He reminded his audience that there was still strenuous work to be done; it was their endeavour to maintain the company's British character untrammelled by external influences.

In a very neat speech Miss C. White proposed the health of the chairman, and Mr. Wilson, in the course of his reply, referred to the recent election of Messrs. Roberts and Winstanley to the board. He pointed out that twelve of the present directors had started with the company in a small way. Although they could not all become directors, there were opportunities for all. Long service was an outstanding characteristic of the organisation. He was sure that no other company did so much for the welfare of its employés.

The "Visitors and Press" toast was proposed by Mr. F. Smith, Mr. F. E. Buckell replying. A musical programme followed, and this was succeeded by a dance.

The seventh annual G.E.C. Junior Social was held on January 3rd in the lecture hall, Magnet House, when nearly 200 members of the junior staff were entertained by the Committee of the Social and Athletic Club and the directors of the company. Dancing and singing, interspersed with games and light refreshments, provided a most enjoyable programme which was thoroughly appreciated by all.

The annual dinner of the staff of the Whitstable Electric Co., Ltd., was held on January 8th, the employés being the guests of the directors. Col. Carnegie, chairman of the board of directors, presided.

The directors of the STEARN ELECTRIC Co. entertained their sales staff to a dinner at the Holborn Restaurant on January 10th. Among those present were Sir Maxwell Hicks, chairman; Mr. Bottome, managing director; Mr. Edgecombe, technical director; Mr. Oldman, sales manager; and Mr. Pollock, sales organiser (Messrs. Maxwell Hicks & Co.). Sir Maxwell Hicks, in the course of his address, expressed the view that, in his opinion, the commercial problem of this country did not lie in production, but in selling—a good sales force was a firm's greatest asset. The best methods of handling customers were discussed, and some interesting points were brought forward; the unanimous opinion seemed to be that it was essential to gain a prospective client's confidence before one could hope for any measure of success.

New Catalogues and Lists.

RADIO INSTRUMENTS, LTD., 12, Hyde Street, New Oxford Street, W.C.1.—A pamphlet giving particulars of the "Madrigal" receiver, which is supplied as a receiver only, as a receiver mounted on a pedestal, and as a receiver mounted on a pedestal including a moving coil loud-speaker.

CALLENDER'S CABLE & CONSTRUCTION CO., LTD., Hamilton House, Victoria Embankment, E.C.4.—A well-produced booklet containing particulars and prices of the company's c.t.s. wiring system. Fully illustrated.

METRO-VICK SUPPLIES, Trafford Park, Manchester.—An illustrated folder giving prices of "Cosmos" lamps.

BRITISH INSULATED CABLES, LTD., Prescot, Lancs.—A pamphlet dealing with "Helsby" wireless condensers, giving prices, capacities and dimensions.

Messrs. MAVOR & COULSON, LTD., 47, Broad Street, Mile End, Glasgow.—Pamphlet No. 253/1 containing details of flameproof controllers.

Messrs. BERNARD HOLLAND & Co., 17, Victoria Street, S.W.1.—A sectional drawing showing features of the "Holland S.L.M." portable rotary compressor, specially designed for high-speed towing and colonial conditions.

A.E.G. ELECTRIC CO., LTD., 131, Victoria Street, S.W.1.—A January stock list of a.c. and d.c. motors, domestic appliances, &c.

A German "Creed" Company.

Messrs. Creed and Co., Ltd., Croydon, announce the formation of a new company in Germany, associated with the International Telephone and Telegraph system, to be known as Creed Telegraphen Apparate G.m.b.H. The object of the new company is to manufacture and exploit the sale of "Creed" printing telegraph apparatus in Germany.

Opposition to Municipal Trading.

It was reported at a retail tradesmen's meeting at Preston on January 9th, that the Chamber of Trade had rejected an application by the Corporation Electricity Department for a stand at an industrial exhibition which the Chamber is organising to enhance the interests of the retailer. It was stated that this course was taken because the Chamber was out to benefit the shopkeeper and to discourage municipal trading in any shape or form, and as the Electricity Department supplied goods to the public, they felt that the stands should be restricted to private tradesmen.

Malayan Rubber Exports.

According to the *Board of Trade Journal* the gross exports of rubber from British Malaya during 1929 were 577,202 tons, as compared with 408,693 tons in 1928.

The Lighting of a Modern Building.

One of the many problems that required careful consideration in the construction of the new offices of the Commercial Union Assurance Company, Ltd., 22, Cornhill, E.C., was the artificial illumination of the general offices, and Siemens gasfilled lamps and "Silvaray" fittings were finally selected by the designers. The accompanying illustration shows a section of the building where the company's "Silvaray" fittings and gasfilled lamps are employed. Over 300 of these fittings have been installed in the offices on the upper floors of this modern building. The whole of the electrical installation of the building was carried out by Electrical Installations, Ltd., under the supervision and to the plans and specifications of Albion T. Snell & Partners, the consulting engineers for all internal engineering services. Mr. Maurice Webb, of Sir Aston Webb & Sons, was the architect.

The Commercial Union Assurance Co.'s Offices.

An Industrial Lighting Exhibition.

The Ministry of Labour for Northern Ireland has organised an Industrial Lighting Exhibition in the Employment Exchange, Corporation Street, Belfast. The exhibition seeks to demonstrate correct lighting, and the exhibits deal with methods of attaining the maximum of lighting efficiency. Excellent models of factory and office interiors, as well as charts and diagrams, are shown, while there is a wide range of photographs of various types of installations. The exhibition, which was opened on January 14th, will conclude on February 1st.

Sir J. Stamp on Rationalisation.

On January 9th, Sir Josiah Stamp, the eminent economist, addressed the Textile Institute at Bradford, on "The Present Position of Rationalisation." He said that there was a great deal of misapprehension regarding rationalisation. The outlook was very serious if it meant nothing more than restricting output and keeping up prices by a system of monopoly or trustification. True rationalisation aimed at reducing costs by greater efficiency; it did not attempt to defeat or delay economic consequences, but it looked to future developments, anticipated them and lessened their adverse effects. It was impossible in these days for small-scale individualistic units to hold their own in foreign trade against large-scale individualistic units. In some industries their were units which could only produce at prices which would lose the whole trade. No form of merger which retained such units in production could be called rationalisation. The principal obstacles in the way of rationalisation were a sort of optimism that conditions would not remain bad and that in due course the trade cycle would produce prosperity; the lack of an impelling agency, particularly if rival banking interests were supporting different units; a desire to preserve the status of units in a financial merger without regard to their efficiency, or the over-capitalisation of merger concerns; and reluctance to reveal the real position of an industry or the relation of its parts, leading to the arrangement of mergers on a purely financial basis.

Naval Officers' Visit to "Hart" Works.

A party of officers from H.M.S. *Vernon* recently paid a visit to the Stratford (London) works of the HART ACCUMULATOR CO., LTD., where they inspected the processes of manufacturing "Hart" batteries for lighting installations, telephone exchanges, central stations, automobiles, &c.

New French Company.

With the title of La Compagnie Générale d'Energie Radio-Electrique, Poste Parisien, a company has just been formed in Paris (4, Rue du Général Foy), with a capital of 5½ million fr. to operate a broadcasting station in the French capital.

The Browett, Lindley Reconstruction.

With reference to the note which appeared on p. 18 of our January 3rd issue, it is now announced that a scheme of capital reconstruction of Browett, Lindley & Co., Ltd., has been approved by the principal debenture holders, and will shortly be placed before the shareholders.

Proposed Scottish Radio Exhibition.

The Radio Manufacturers' Association has applied for the use of Kelvin Hall, Glasgow, for the purpose of running a radio exhibition in 1931, and the application is being considered by a sub-committee of the Corporation.

Czecho-Slovakian Electrical Imports.

During November last, Czecho-Slovakia imported electrical machinery and apparatus valued at 29 million crowns (£175,600), bringing up the total for the first eleven months of last year to 312 million cr. (£1,900,000), against 229 millions (£1,400,000) in January-November, 1928.

The Timber Market.

Our Timber Trade Correspondent states that the year has opened with a record stock of European woods, and at prices more favourable to consumers compared with those of a month or two ago. Moreover, Russia promises to send much larger supplies this year than last, and as wholesale prices for these are very favourable to buyers, there is every promise of a good consumption in the general building and other wood-using industries. The hardwood market continues quiet, with stocks generally low, excepting American woods. Teak is still dear, and as available stocks at Indian shipping centres are light and forward, orders taking some considerable time to fulfil, there is little chance of any easing in wholesale prices. Not many mahogany logs are expected, and prices are upward for these descriptions. Satinwood, rosewood, ebony, and other fancy varieties keep very steady in value, with stocks moderate and in firm hands.

Prices of Materials.

Messrs. James Forster & Co. state in their letter of January 11th that the lead market last week was quiet and prices fluctuated within narrow limits. Lead producers raised their price early in the week by 2s. 6d. per ton, but this failed to stimulate demand, which remained dull, buying being of a hand-to-mouth character. Supplies meanwhile promise to be very full for the next six weeks.

Messrs. F. Smith & Co. and Messrs. James & Shakespeare report, January 14th: No change in copper and lead prices.

Messrs. Edward Till & Co. report, January 14th: India-rubber, Para fine, 8d., ½d. dec.

We have received from Messrs. M. H. Cawson & Co., 60, Gracechurch Street, E.C.3, a chart showing the net monthly average market prices of imported soft pig lead, from 1919 to 1929 inclusive.

Lighting and Power Notes.

Arabia.—HEJAZ.—According to *The Times*, the Hejaz Government is contemplating a scheme for the installation of electrical plant midway between Jeddah and Mecca to supply both cities with electricity and later to run an electric tramway.

Bacup.—UNEMPLOYMENT SCHEME.—The Town Council has decided to submit a scheme for mains extensions costing £10,900 to the Unemployment Grants Committee, as an unemployment relief scheme.

Birkenhead.—MAINS EXTENSION SCHEMES.—The Corporation Electricity Committee is to proceed with the laying of 6,600-V mains together with the provision of the necessary switchgear, &c., (*a*) from Bentinck Street works to South End sub-station, (*b*) from South End sub-station to New Ferry sub-station, (*c*) from Borough Road to Bedford Avenue for the Albany Road district, and (*d*) from Stanley Road to Gautley Road for the Bidston estate.

LOANS.—The Corporation Electricity Committee is applying for sanction to loans of £9,092 for mains and £1,633 for switchgear, transformer and kiosks.

Brentford.—DOCK LIGHTING IMPROVEMENTS.—The lighting of Brentford Docks is to be improved by the Great Western Railway by the provision of a modern electrical installation. Flood-lighting is to be provided at points where the system can be conveniently adopted.

Bristol.—LOAN.—The Corporation Electricity Committee is applying for sanction to the borrowing of £100,000 for services.

Buckie.—SPECIAL ORDER.—The Town Council has decided to apply to the Electricity Commissioners for a Special Order authorising it to supply and distribute electricity, and on an Order being granted to proceed immediately with the carrying out of an electricity scheme costing £14,625.

Canada.—PLANT EXTENSIONS.—According to the *Financial Times*, contracts totalling $500,000 (£100,000) have been awarded by the British Columbia Electric Railway Company for the construction of the fourth generating unit of the Jordan River plant on Vancouver Island. More than half the amount will be spent in British Columbia, and the whole sum will be expended within the British Empire. In addition, it is estimated that approximately $200,000 (£40,000) will be spent in installing the equipment.

ELECTRICITY SUPPLY.—The Shawinigan Water and Power Co. has completed its h.p. transmission line from its plant at Grand'Mere on the upper St. Maurice River to the mill of the Brown Corporation at La Tuque, a distance of 67 miles. The line is designed to carry 200,000 h.p. at 250,000 V, but is operating initially as a single-circuit three-phase line at 66,000 V. There are six towers to the mile, each of galvanised steel 90 ft. high and weighing from six to fifteen tons.

BRITISH COLUMBIA.—According to the *Financial News* the West Kootenay Power & Light Co., Ltd., is to begin construction before the end of the current year of the granite dam at the outlet of Kootenay Lake. This dam is designed to control the level of the lake with the object of preventing or lessening periods of low water and thus of increasing the output from the company's hydro-electric power plants at Upper and Lower Bonnington Falls and at the new plant at South Slocan. A power plant is also to be built at a cost of $2,500,000 on the Adams Lake and Shuswap Lake, construction to begin in February. The power developed at the new station will be distributed in the Kelowna, Penticton, and Oliver districts in Central British Columbia, and to the mining plants in the neighbourhood of Copper Mountain, thus relieving the pressure on the Kootenay development. The total expenditure involved in all of these schemes is estimated at $4,000,000.

Chopwell.—ELECTRICITY RE-INSTALLED.—Re-installation work in connection with the electricity supply has been commenced in about 700 colliery houses. The supply was cut off in 1925, when the miners refused to accept an alteration in the method of payment from 8d. per week per light to a flat rate per kWh with meter rent.

Clitheroe.—ELECTRICITY EXTENSION INAUGURATION.—The inauguration of the Corporation's electricity extension to the West Riding villages of Waddington, West Bradford, and Grindleton will take place to-morrow. The Mayor and town councillors, consulting engineers, and contractors, and over forty guests will assemble at the dinner arranged in connection with the event. There will be a film shown at the picture house exhibiting the many purposes to which electricity can be applied in country places.

Colchester.—ELECTRICITY SUPPLY EXTENSIONS.—At a meeting of the Corporation Electricity Committee held recently, a report on the progress of the preliminary work in connection with the construction of transmission lines to Ardleigh and Mannington was presented, and it was decided that application should be made for sanction to the borrowing of £7,107, the estimated cost of a proposed line from Hythe generating station to Ardleigh.

Continental.—FRANCE.—In order to meet the increasing demand for power supply in the Paris district, the Société Union d'Electricité, which, in addition to its own power stations, is already taking supplies from the hydro-electric power stations at Eguzon and Coindre of the Société de l'Union Hydro-Electrique and the Paris-Orleans Railway Co., is, in conjunction with the two other electricity supply undertakings in Paris, engaged in completing similar arrangements with a number of other hydro-electric undertakings in Central France. As a result it is estimated that, by the early part of 1933, the three companies will be able to rely in the winter months on 200,000 kW from the plants in Central France, this being transmitted by two main 220,000-V transmission lines.

SWEDEN.—The Swedish Waterfall Board is asking the Government to propose to the next Riksdag the construction of a hydro-electric power station at Vargon, on the Gota River, on which the big Government-owned Trollhattan power station is situated. The cost of the new station is estimated at about £513,000.

Coventry.—LOAN.—The City Council has applied for sanction to a loan of £1,736 for mains.

Crewkerne.—ELECTRICITY SUPPLY.—Work is shortly to be commenced on the provision of electricity in the urban district of Crewkerne, for which area an Order has been granted to the South Somerset and District Electricity Co., Ltd.

Dagenham.—NEW HOUSING ESTATE SUPPLY.—The Urban District Council has arranged with the County of London Electric Supply Co., Ltd., to provide mains, services, wiring, and lighting fittings in connection with the new housing estate at 18s. 8d. per point for a total of 107 houses. Electricity is to be supplied at an " all-in " rate per point, or on a two-part tariff system.

Dewsbury.—ELECTRICITY SUPPLY DECISIONS.—Following its recent decision to cease generating locally and to take a bulk supply from the Yorkshire Electric Power Co., the Town Council has decided to change over gradually from d.c. to a.c. where necessary; to seek borrowing powers for £45,000 for new cables and to apply for aid from the Unemployment Grants Committee; and to seek sanction to a loan of £10,000 to meet the cost of conversion plant in connection with the purchase of a bulk supply from the power company.

Felixstowe.—LOANS.—The Urban District Council Electricity and Lighting Committee is to apply for sanction to loans of £700 for mains and services for street lighting, £500 for standards and fittings, and £1,000 for the purchase of cookers and water heaters to be let out on hire.

Glasgow.—ELECTRICITY SUPPLY.—Regarding the supply of electricity in Shettleston and Tollcross area the town clerk reported to the Corporation Electricity Committee that he had intimated to the Clyde Valley Electrical Power Co. that the Corporation could not entertain the claims made by the company for an extension of the agreement for the distribution of electricity by the company within the area of supply authorised by order of 1906 and in respect of severance. He submitted a letter from the company intimating that it adhered to the claims and that, in view of the position taken up by the Corporation, there appeared no alternative to arbitration, and asking the Corporation to approve the appointment of an arbitrator from a list of names submitted. The Committee did not see its way to accept any of the names suggested by the company and agreed that the Board of Trade be asked to appoint an arbitrator.

MAINS EXTENSIONS.—The Corporation Electricity Committee recommends that distributing mains be laid as follows:—Ordinary extensions, £4,606; change-over cables, Kelvinside, £21,440; distribution mains from Partick Cross sub-station, £14,696; change-over cables, Ibrox and Bellahouston, £13,180.

PROGRESS DURING NOVEMBER.—During the month of November, 1,003 houses were wired under the Electricity Department's scheme making a total of 18,552, while hired appliances numbered 520, bringing the total to 19,713.

Halifax.—HIRE-PURCHASE WIRING SYSTEM.—The Corporation Electricity Department has instituted a hire-purchase wiring scheme for domestic consumers, the cost of the installation being spread over three years. The scheme is confined to installations of not fewer than four switch points and not more than fifteen, and includes shades, but not lamps. With the exception of lamps and shades, the installation is guaranteed for three years. The local electrical contractors are working in collaboration with the Electricity Department in the matter.

Hastings.—SUPPLY EXTENSION SCHEMES.—The Corporation Electricity Committee has prepared schemes for extensions in the town, including a feeder for a bulk supply to Bexhill, at a cost of £37,887, and for work in the extended area, at a cost of £27,055.

LOAN.—The Committee is to apply for sanction to a loan of £2,000 for the provision of transformers.

Llantarnam.—ELECTRICITY CHARGES DECISION.—At the monthly meeting of the Urban District Council held recently it was resolved that the following tariff for electricity should be adopted:—Lighting, flat rate, 7d. per kWh; power, 2d. per kWh, with special terms for large consumers; prepayment lighting for consumers providing their own installations, 7½d. per kWh, including meter rent; prepayment lighting in cases where the installations are provided by the Council, 9d. per kWh. It was further decided to sign the agreement with the South Wales Power Co., Ltd., for the purchase of a bulk supply of electricity for the undertaking.

London.—SOUTHWARK.—The Borough Council Electricity Committee reports that the question of increasing the output of the generating station has been under consideration for nearly four years, and every possible channel has been thoroughly explored with a view to obtaining a supply on the most economical basis. After consultation with the Joint Electricity Authority and the Electricity Commissioners, the Committee has decided to recommend that the negotiations with the City of London Electric Lighting Co., Ltd., which is considering a scheme for the extension of its power station.

Manchester.—NEW PLANT.—The Corporation Electricity Committee has decided to make application to the Electricity Commissioners and to the South-East Lancashire Advisory Board for sanction to install the additional boiler plant now required at the Barton station.

PROGRESS DURING NOVEMBER.—During the month of November the Corporation electricity undertaking showed an increase in connections of 3,325 kW, bringing the total up to 410,725 kW. The number of applications received for supply, including those for additional supplies, amounted to 1,507 and represented a total of 3,581 kW. The number of hired cookers connected increased by 73, making the total number of cookers actually connected 5,774. Applications for the hire of cookers totalled 131. Two new sub-stations were put into commission and additional plant was installed at three existing sub-stations. The change-over from d.c. to a.c. had been completed in the cases of 8,519 consumers up to December 14th, and sanction had been given and work was in progress involving 1,206 consumers.

LOANS.—The Corporation Electricity Committee is to apply for sanction to loans of £250,000 for distribution mains, £6,000 for sub-station buildings, and £34,000 for sub-station equipment, plant, &c.

Marlborough.—BULK SUPPLY NEGOTIATIONS.—The Town Council having failed to obtain a supply of electricity in bulk from the Swindon Corporation, is negotiating for a supply from the Wessex Electricity Co. If an agreement is reached, the company will run a line to Marlborough by way of Ramsbury and Mildenhall.

Monmouth.—SALE OF UNDERTAKING.—The Town Council, at a special meeting held recently, decided to sell its electricity undertaking to the General Electric Co., Ltd., for £16,000. Only one member of the Council voted against the proposal.

Newcastle-under-Lyme. — PRICE REDUCTIONS.—The Corporation Electricity Department has made the reductions in the charges for electrical energy as from the first of this month. Included in these is a multi-part tariff for all domestic purposes in private houses only: A fixed charge of 5s. per quarter per room, plus 1d. per kWh for the first 480 kWh per quarter, ¾d. for all energy consumed above 480 kWh, and ½d. for all energy consumed above 960 kWh per quarter, providing a thermostatically-controlled hot-water system (with loading not exceeding 2 kW) is installed.

Northern Ireland.—ELECTRICITY SUPPLY INVESTIGATIONS.—The Northern Ireland Government has appointed Mr. J. M. Kennedy to examine and report on the present state of electricity in Northern Ireland. Inquiries are to be held in various centres in the six counties, and extensions of existing generating plants will be considered.

Oldham.—BULK SUPPLY.—At a recent meeting of the Corporation Electricity Committee a communication was submitted from Mr. R. Blackmore, district engineer of the Central Electricity Board, inquiring if the Committee had any plant available which could be utilised for providing bulk supplies under temporary arrangements until the Board's scheme came into operation in about two years' time. It was decided to inform the district engineer that the Committee had certain plant available for the purpose indicated, and was prepared to afford a temporary supply, on the understanding that this arrangement shall not in any way interfere with or prejudice the supply of energy by the Corporation to consumers within their area of supply.

Plymouth.—ELECTRICITY SUPPLY.—The Corporation Electricity Committee has agreed upon terms with the Cornwall Electric Power Co., for the supply of electrical energy at Torpoint and Saltash and the area as far as St. Germans. The supply is to be given at two points, one at Saltash and the other at Pottery Quay. With regard to the recent inquiry into the applications of Messrs. Heath & Co., and the Torquay Corporation to supply electricity in the Ivybridge, Kingsbridge and Totnes rural areas, the Torquay Corporation has withdrawn the application in respect of the supply in Ivybridge.

Sheffield.—MAINS EXTENSIONS.—The Corporation Electricity Committee has authorised mains extensions at a cost of £4,070.

Sidmouth.—PURCHASE OF UNDERTAKING.—The East Devon Electricity Co., Ltd., is promoting a Bill in this session of Parliament for the confirmation of an agreement entered into for the acquisition of the Sidmouth Urban District Council's electricity undertaking. The sum named is £35,372, with interest at 6 per cent. as from July, 1929, until the completion of purchase. The Whitehall Securities Corporation, Ltd., is guaranteeing the due performance by the company of its agreement.

Soham.—ELECTRICITY SUPPLY.—The Soham Gas Co. has decided not to proceed with its application for powers to supply electricity in Soham and the neighbouring parishes.

Special Orders.—Applications have been made to the Electricity Commissioners for Special Orders by the Waste Heat Owners Co., Ltd., to supply electricity in various districts in the counties of Westmorland, Cumberland, Lancaster, and the West Riding of Yorkshire; by the Portsmouth Corporation to extend its area of supply so as to include the parish of Hambledon, in the rural district of Droxford; and by the Lathom and Burscough Urban District Council to supply electricity in the urban district of Lathom and Burscough.

The Electricity Commissioners have submitted to the Ministry of Transport for confirmation, Special Orders made by them authorising the Worksop Urban District Council to supply electricity in the parish of Whitwell, in the urban district of Clown; and the Swindon Corporation to supply electricity in the parish of Stratton Saint Margaret, in the rural district of Highworth.

Stockport.—POWER STATION EXTENSIONS.—The Town Council has submitted to the Electricity Commissioners for approval an estimate of expenditure for the extension of the Millgate power station. The estimate provides for a 20,000-kW turbo-alternator, four 50,000-lb. boilers, buildings, and other equipment, the total cost being £260,000.

Swindon.—ADMINISTRATION.—The Town Council has decided that in future the Corporation Electricity and Omnibus Department shall be divided into two sections. The transport section will now be under the supervision of Mr. W. Medcalf, formerly secretary to the department and omnibus manager, while Mr. S. Nicklin, formerly chief engineer of the department, will be in charge of the electrical section.

Torquay.—BULK SUPPLIES.—At a meeting of the Corporation Electricity Committee, held recently, the town clerk and the borough electrical engineer were authorised to meet the representatives of the Dartmouth and Kingsbridge authorities, and make the necessary arrangements for the settlement of bulk supply agreements between them and the Corporation.

Winchester.—ELECTRICITY SUPPLY.—The City Council has received sanction to a loan of £2,053 in connection with the supply of electricity to Twyford and Compton. The charges fixed for these parishes are: 9d. per kWh for any use other than power, and 5d. per kWh for power. The Council has also arranged with the city electrical engineer for a supply of electricity to houses being erected at St. Martin's Close.

Worcester.—LOAN.—The City Electricity Committee proposes to borrow £34,000 for the development of the distribution system.

Tramway and Railway Notes.

Bradford.—RAILLESS CARS.—The Corporation Electricity Committee has agreed, subject to the approval of the Finance Estimates Sub-Committee, to provide the additional feeders required owing to the substitution of railless-car services for trams on the Allerton route, at an estimated cost of £6,250.

Chesterfield.—RAILLESS-CAR EXTENSIONS.—The Town Council is to make application for sanction to the borrowing of £1,760 to meet the excess expenditure in connection with railless-car extensions.

Hastings.—RAILLESS-CAR EXTENSIONS.—Application is being made by the Hastings Tramway Co. for sanction to extend its railless-car routes in Hastings and Bexhill, and also to run 'buses in prolongation of, or connection with, existing or new railless-car services.

London.—THE PICCADILLY TUBE EXTENSION.—The sites of eight new stations on the proposed Piccadilly Tube extension from Finsbury Park to Cockfosters have been decided on by the Underground Railway authorities. The new stations will be at Manor House Corner, Turnpike Lane, Wood Green, Brownlow Road, (Bounds Green Road), Arnos Grove (Bowes Road), Southgate Chase Side, East Barnet Road, and Cockfosters. It is hoped to obtain Parliamentary sanction by the end of July, and the work on the extension will then begin.

Portsmouth.—RAILLESS CARS.—The Corporation is to promote a Bill in Parliament to provide for the substitution of a railless-car system for the tramways, with powers for the Minister of Transport to authorise further railless-car routes within and outside the city.

Southport.—PROPOSED TRAMWAY ABANDONMENT.—The Town Council is considering the question of substituting motor-omnibuses for trams, and the Tramways Committee has instructed the manager to prepare a report on the tramway system together with proposals with regard to the establishment of 'bus services.

The Southern Railway.—ELECTRIFICATION EXTENSIONS.—According to the Southern Railway's works programme for 1930, a sum of £597,500 is to be expended on electrification extensions. In addition to the Reigate, Redhill, Brighton and Worthing electrification scheme, the following extensions, which it is hoped to bring into operation this summer, have been authorised:—(*a*) Dartford to Gravesend, 14 miles; (*b*) Wimbledon to West Croydon, 8 miles; and (*c*) Twickenham to Windsor, 27¼ miles.

Torquay.—RAILLESS CARS.—The Corporation resolved at a meeting held recently to sanction, under certain conditions, the substitution by the Torquay Tramways Co., Ltd., of railless cars for the existing tramcars. One of the principal factors leading to this decision is the congestion caused by the trams in the main streets. The agreement with the Tramways Company provides that the Corporation shall have the option at the expiration of 14 years, and at the end of every subsequent seventh year, of purchasing the undertaking as a going concern, and all the electrical energy has to be taken from the Corporation's works.

United States.—NEW YORK.—The City authorities are giving favourable consideration to a proposal to construct a railway tunnel under Kill van Kull, the channel which separates Staten Island from Bayonne, New Jersey. The scheme, says *The Times*, is part of a proposed rapid transit development in New Jersey, but it has the direct advantage for New York that it would provide, at a cost to New York of only $6,000,000 (£1,200,000), a connection between Staten Island and Manhattan, by way of New Jersey, which otherwise would have to be made at a cost of $80,000,000 (£16,000,000) by way of Brooklyn and a tunnel under the Narrows. Part of the route will be by subways and part by surface railway. From Jersey City there will be a direct connection between the new route and Manhattan by way of the existing Hudson and Manhattan Company tubes, which reach the Manhattan shore at Cortland Street and Christopher Street.

Telegraph and Telephone Notes.

Atlantic Cables.—REPAIR WORK.—It was announced on January 8th that the Western Union Telegraph Co.'s fast cable between New York and Bay Roberts, Newfoundland, which was interrupted by the earthquake in November, had been reopened for traffic. This is the loaded cable, laid in 1926, which connects at Bay Roberts with the transatlantic section of the same type terminating at Sennen, Cornwall. The work of repairing the cable was carried out by the company's ship *Lord Kelvin*, in spite of the severe weather and the great depth of water (nearly 3,000 fathoms) at which the cable had to be grappled for.

China.—CABLE TELEGRAPHY.—The agreements between China and the Eastern Extension and the Great Northern companies, whose interests are pooled, expire in December, 1930, and the exclusive rights granted to them by those agreements will not be renewed. The Chinese Government, which owes a large sum to the companies, shows no desire to purchase the cables, or to interfere with the business of the companies, though it may seek to make a good bargain for the renewal of the companies' right to continue their service, says *The Times*.

The wireless installations now being erected for the Chinese Government with American capital will, it may be assumed, appropriate a share of the telegraph traffic.

France.—AUTOMATIC TELEPHONE EXCHANGES.—Four of the telephone exchanges in the Paris district have been equipped for automatic operation, and the necessary material for nine other exchanges has been ordered. As a result, it is expected that within about two years half of the telephone subscribers in the Paris area will be connected to automatic exchanges.

United States.—CABLE AND RADIO MERGERS.—American telegraph interests hold different views on the British communication authorities' merger and world-wide cable and radio services. Some hold that it constitutes a real menace to American companies while the other view, as expressed by Mr. Newcomb Carlton, president of the Western Union Telegraph Company, is that it is merely "a fantastic bogey." The issue is a live one because consolidation similar to the British is under way in Germany, France, and Italy, and also because a United States Senate Committee is listening to arguments *pro* and *con* regarding the repeal of the anti-merger provisions of the present law.

Independent communication services oppose the proposed merger on the ground that cable control of wireless would stifle development, and constitute a barrier to any further reduction of rates, says the *Daily Telegraph*. Officials directly interested in the proposal, however, declare that, with American communication companies competing against each other, the unified interests of Britain will be able to play off cables against radio in America, and deal with whichever one is most amenable to British interests.

Radio Notes.

Belgium.—TWO NEW STATIONS.—Radio-Belgique states that two high-power stations are under construction at Veltham, between Brussels and Louvain. One is being built for Radio-Belgique and the other for the N.V. Radio. The two transmitters will be housed in the same building, and will be operated jointly by the two companies. According to *World Radio*, the two aerials will be supported by three masts each 100 metres in height; the down-leads are of the "feeder" type. The two transmitters will deliver a power of 15 kW to the aerial, and it is expected that this power will be sufficient to cover the whole of Belgium.

Gale Damage.—During the gale on January 12th, telephone lines between Birmingham and Daventry were put out of order and 5GB could not transmit the programme from Bir-

mingham. The lines between London and Daventry were also damaged, and the B.B.C. was compelled to work on one line instead of the four lines usually in use. The lines between London and Gloucester were out of order, and stations which normally take their programmes through Gloucester, *viz.*, Cardiff, Swansea, and Plymouth, had their programmes relayed *via* London, Leeds, Birmingham and Gloucester.

Germany. — BROADCASTING REORGANISATION. — The Berlin correspondent of *World-Radio* reports that the German Post Office is sending this month, with the usual licence receipt, a form in which listeners are requested to state to which station or stations they listen, and whether their reception is interfered with. The information will be of value in connection with the proposed reorganisation of the German broadcasting system.

United States.—"CHAIN" STATIONS.—One of the most interesting technical features of American broadcasting is the network system of simultaneous transmission by means of which a chain of stations, connected by telephone lines, radiates the same programme about six hours each day. At present six chains are operating, each network being assigned a characteristic colour for reference purposes. For example, the red network has 41 stations, the telephone circuit used having a length of 10,300 miles, while the green network has only eight stations and requires only 3,600 miles of wire circuit.

The practice of selling broadcasting services to commercial organisations which "sponsor" programmes is now the standard American method of making a service self-sustaining. The National Broadcasting Company, which controls three such networks as those mentioned above, has studios in New York, Washington, Chicago, and San Francisco, and although it possesses stations of its own, its real function is that of producing and distributing programmes which are finally radiated by stations belonging to various commercial companies. The programmes supplied are either "sponsored" or "sustaining." The former are financed by industrial firms for advertisement, while the latter are provided by the company. The stations on the chain take a share in the payments received by the company for the sponsored programmes, but have to pay the company for sustaining programmes. At present the sponsored programme payments more than compensate for the cost of the sustaining programmes, says *The Times*.

By linking up network systems it is possible on special occasions to link up a very large number of stations. For example, on November 5th, 1928, the evening of the Presidential election as many as 85 stations radiated a common programme, which was listened to by an audience estimated at 50,000,000.

Contract Information.

When "Contracts Open" are advertised in our "Official Notice" pages, the date of the ELECTRICAL REVIEW containing the advertisement is given in parentheses below.

Contracts Open.

Australia.—MELBOURNE.—Posts and Telegraph Department. February 18th. Jacks and number plates. (B.X. 5940.)*
February 25th. Jumper rings and terminal strips. (B.X. 5941.)* Switchboard plugs. (B.X. 5998.)* Magneto and c.b. telephones and automatic dials. (B.X. 5999.)* Telephone switches. (B.X. 6018.)*
March 24th. Dial parts. (B.X. 6047.)*
February 10th. State Electricity Commission of Victoria. Two 6,000-kVA, 3-phase transformers with spare coils and bushings. (B.X. 6014.)*
February 26th. Victorian Railways. Deaerators and accessories. (A.X. 8935.)*

Basingstoke.—February 8th. Electricity Department. Supply, delivery, and erection of two heavy oil engines, each direct-coupled to one 800-kW, 3-phase, 50-cycle alternator. (See this issue.)

Bath.—January 22nd. Electricity Department. Supply of one 60,000-lb. boiler, one 7,000-kW turbo-alternator, and e.h.p., h.p. and l.p. cables required over a period of 12 months. (January 3rd.)

Blackpool.—Corporation. Supply of six 6,600-V, 50-cycle, 3-phase sub-station switchboards. (January 10th.)

Cheadle and Gatley.—February 11th. Electricity Department. Supply and delivery, as required, during the twelve months ending March 31st, 1931, of cables, lamps, meters, street lighting standards, electrical fittings, &c. (See this issue.)

Chile.—SANTIAGO.—February 19th. Chilean State Railways. Railway signalling apparatus. (A.X. 9008.)

Cowdenbeath.—January 29th. Town Council. Electrical installation for 32 houses. Specifications, &c., from Mr. C. A. Alexander, burgh surveyor, Cowdenbeath (2 guineas deposit).

Eccles.—January 25th. Electricity Committee. One 250-kVA, three-phase, oil-cooled transformer. Specification (deposit £1 1s.) from Borough Electrical Engineer, Electricity Works, Cawdor Street, Patricroft.

Grimsby.—January 23rd. Electricity Department. One 10,000-kW 3-phase turbo-alternator with condensing plant. (December 27th.)

India.—South Indian Railway Co., Ltd. January 24th. Madras improvement (electrification): Cables and accessories. (December 27th.)

Latvia.—January 22nd. Post and Telegraph Department, Riga. Telephone cable. (B.X. 6054.)*

Liverpool.—January 23rd. Corporation. Supply and delivery for twelve months ending March 31st, 1931, of cables, meters, lamps, lubricating oils, and other materials. (January 3rd.)

London.—CENTRAL ELECTRICITY BOARD.—January 20th. Supply, delivery, and erection of 3,300-V, 6,600-V, and 11,000-V switchgear for connecting the Board's supply to undertakers' busbars, North-West England and North Wales Scheme, (December 13th.)
February 1st. Supply, delivery, and erection of 33,000-V overhead transmission lines for the South-East England Electricity Scheme, 1927. (January 3rd.)
ISLINGTON.—February 5th. Electricity and Lighting Committee. Steel tube street lamp columns, and street lanterns. (See this issue.)

Manchester.—January 24th. Electricity Committee. Sheet-steel neutral earthing cubicles, &c., for power transformers at Cumberland Street sub-station. (January 10th.)

New Zealand.—WELLINGTON.—Post and Telegraph Department. February 3rd. Protector blocks made of carbon and porcelain. (B.X. 5948.)*
January 28th. Three conductor plugs. (B.X. 6028.)*
January 29th. Condensers. (B.X. 6031.)*
January 30th. 500 bell receivers. (B.X. 6029.)*
February 13th. Opal lamp caps. (B.X. 5955.)*
March 24th. Resistances and reactances. (B.X. 6046.)*
April 29th. Public Works Department. One 10,000-kVA synchronous condenser and accessories. (B.X. 6034.)* Single-phase transformers and accessories. (B.X. 6035.)*
April 29th. Public Works Department. One 10,000-kVA Waitaki power scheme. (B.X. 6048.)

Portsmouth.—February 10th. Tramways Committee. Supply of goods, including insulating materials, lamps, motor windings, overhead line materials, &c., from April 1st to March 31st, 1931. (See this issue.)

South Africa.—LOUIS TRICHARDT.—February 18th. Municipal Council. Supply and erection of a distribution system for the town, including the supply of poles, copper conductors, transformers meters &c. (B.X. 6003.)
JOHANNESBURG.—February 13th. S. A. Railways and Harbours. Electric tube butt welding set. (B.X. 6005.)
February 20th. Municipal Council. Transformers (B.X. 6043.)* Switchgear (B.X. 6044.)*

Stoke-on-Trent.—February 12th. Electrical Engineer's Department. Electric mains van. (See this issue.)

Sutton Coldfield.—Electricity Department. Supply of paper-insulated, lead-sheathed, double steel tape armoured cables. (See this issue.)

Worksop.—January 21st. Rural District Council. Wiring 26 houses at North Carlton. The Surveyor, Council Offices, Highfield House, Carlton Road, Worksop.

* Further particulars can be obtained at the Department of Overseas Trade (Inquiry Room), 35, Old Queen Street, S.W.1.

Contracts Closed.

Bangor.—City Council. Accepted:—
Domestic installation work under the new scheme.—Owen and Palmer.

Birkenhead.—Electricity Committee. Accepted:—
Transformer cubicle, panel cubicle and feeder panel (£282).—General Electric Co., Ltd.

Feeder panel.—Ferguson, Pailin, Ltd.
Cable.—W. T. Glover & Co., Ltd. (£3,214); Hackbridge Cable Co., Ltd. (£1,405); Macintosh Cable Co., Ltd. (£2,258).
Libraries Committee. Recommended :—
Electrification of lift at Art Gallery.—Express Lift Co.

Bradford.—Education Committee. Accepted :—
Electric lighting installation at Bolling new secondary school for girls.—J. Carter, £1,088 (in place of a lower tender, withdrawn).
Electricity Committee. Accepted :—
H.p. steam piping for No. 9 turbine at Valley Road station.—Aiton & Co., Ltd.
Main steam valves for No. 9 turbine.—Hopkinsons, Ltd.

Dewsbury.—Town Council. Accepted :—
Switchgear (£2,235).—Ferguson, Pailin, Ltd.

Eastbourne.—Electricity Committee. Recommended :—
Overhead lines to Friston and East Dean (£2,537).—W. T. Henley's Telegraph Works Co., Ltd.

Glasgow.—Housing Committee. Recommended :—
Electrical installation for 120 houses at Janefield Street rehousing scheme (£476).—A Robertson.
Transport Committee. Accepted :—
Brake levers for bogie cars.—Kilmarnock Engineering Co., Ltd.
Lead-covered cable.—Hackbridge Cable Co., Ltd., and Standard Telephones and Cables, Ltd.
Special work.—Hadfields, Ltd., Titan Trackwork Co., Ltd., and Edgar Allen & Co., Ltd.
Health Committee. Recommended :—
Installation of electric light at Shieldhall Hospital (£864).—Darroch & Espie.

Hastings.—Electricity Committee. Recommended :—
Switchgear (£11,395).—English Electric Co., Ltd.
Watch Committee. Recommended :—
Electric traffic signals (£1,387).—Barber & Colman, Ltd.

Irish Free State.—DUBLIN.—City Commissioners. Recommended :—
Electrical installation at the Dublin City Abattoir (£1,897).—Haden's Engineering Co., Ltd.

London.—HACKNEY.—Electricity Committee.
Boiler house, boiler house plant and accessories, including coaling gear :—

SIMON-CARVES, LTD. (Recommended) ...	£222,039
John Thompson Water Tube Boilers, Ltd. ...	223,495
Stirling Boiler Co., Ltd.	238,756
Mitchell Conveyor and Transport Co., Ltd.	250,795
Underfeed Stoker Co., Ltd.	254,501
Babcock & Wilcox, Ltd.	255,051

Overhead travelling crane :—

HERBERT MORRIS, LTD. (Recommended) ...	£3,040
Vaughan Crane Co.	3,115
Ransomes & Rapier, Ltd.	3,595
Babcock & Wilcox, Ltd.	3,928
Stothert & Pitt, Ltd.	4,170

Turbine house plant :—

A. E. G. Electric Co., Ltd.	£84,516
Brush Electrical Engineering Co., Ltd. ...	102,750
C. A. PARSONS & Co., LTD. (Recommended)	105,484
Richardsons, Westgarth & Co., Ltd. ...	105,600
English Electric Co., Ltd.	106,001
British Thomson-Houston Co., Ltd. ...	106,350
Fraser & Chalmers Engineering Works, Ltd.	107,543
Metropolitan-Vickers Electrical Co., Ltd. ...	108,887

Alternative tenders :—

C. A. Parsons & Co., Ltd.	99,993
English Electric Co., Ltd.	101,501

Switchgear :—

General Electric Co., Ltd.	£77,224
A. REYROLLE & Co., LTD. (Recommended)	77,900.
English Electric Co., Ltd.	78,567
Ferguson, Pailin, Ltd.	80,541
Park Royal Engineering Co., Ltd.	81,908
British Thomson-Houston Co., Ltd. ...	83,314
Metropolitan-Vickers Electrical Co., Ltd. ...	84,911

Renewal of battery for the mains electric lorry (£216) less credit for old battery.—D. P. Battery Co., Ltd.
SOUTHWARK.—Electricity Committee. Recommended :—
Battery plates (£166).—Alton Battery Co., Ltd.
Slot meters.—R. Hornby & Co., Ltd.

Manchester.—Housing Committee. Accepted :—
Electrical installations at various housing estates.—R. H. Clampnett & Co.; G. F. Latham; Hall & Stimsen, Ltd.; and F. L. Napier & Co.
Education Committee. Accepted :—
Electric lighting at gymnasium of Levenshulme High School.—J. Adams, Ltd.
Electrical installation at New Moston school, J. Adams, Ltd.; at Varna Street school and St. Mary's Road school, A. E. Sudlow & Co.
Transport Committee. Accepted :—
Tram rail bonds.—Forest City Electric Co., Ltd.

Marsden.—Urban Council. Accepted :—
Installing electric light at 16 houses.—George Chambers.

Newport Pagnell.—Rural Council. Accepted :—
Installing electricity in houses at Hanslope, at £2 16s. per house.—Northampton Electric Light Co.

Oldham.—Education Committee. Accepted :—
Electric light installation at Freehold school, and wiring, &c., at Electrical Engineering Laboratory.—Charlesworth & Co.
Electricity Committee. Accepted :—
Cable.—Union Cable Co., Ltd.

Reigate.—Town Council. Accepted :—
Cable extensions in Carlton Road, Redhill.—Callender's Cable and Construction Co., Ltd.
Wiring small houses under the hire-purchase scheme (13s. 5d. per point, with an extra 8s. 6d. for a two-way switch on any point).—T. S. Marriage & Co., Ltd.

South Shields.—Electricity Committee. Recommended :—
Battery repairs and plate renewals (£1,685).—Tudor Accumulator Co., Ltd.

Forthcoming Events.

British Electrical Development Association.—Friday, January 17th. Royal Society of Arts, Adelphi, W.C. 7.30 p.m. "Domestic Hot Water." Mr. C. H. Smith.

(North-West Area Sales Conference).—Wednesday, January 22nd. Lighting Demonstration Bureau, Manchester. 6.30 p.m. "Sales Possibilities of Electricity in Advertising." Mr. H. Lingard.

Association of Supervising Electrical Engineers.—Tuesday, January 21st. Junior Institution of Engineers, 39, Victoria Street, S.W. 7.15 p.m. "Recent Developments in Modern Electric Lifts." Mr. L. S. Atkinson.

Illuminating Engineering Society.—Tuesday, January 21st. Royal College of Music, South Kensington. 7 p.m. "Stage Lighting." Mr. C. H. Ridge.

Institute of Wireless Technology.—Wednesday, January 22nd. Engineers' Club, W. 7 p.m. "Notes on the Fading of Wireless Signals." Mr. A. M. Houston Fergus.

Electrical Contractors' Association.—Wednesday, January 22nd. Savoy Hotel. 6.30 for 7 p.m. Annual dinner.

Edinburgh Electrical Society.—Wednesday, January 22nd. 16, Royal Terrace, Edinburgh. "Photo-Electric Cells." Mr. H. C. Walker.

Friday, January 24th. Royal Arch Hall. Whist drive and dance.

Electrical Association for Women.—Thursday, January 23rd. 46, Kensington Court, W. 3 p.m. New Year social.

Institution of Electrical Engineers.—Thursday, January 23rd. Institution, London, W.C. 6 p.m. "The Breaking Performance of High Power Switchgear and of a New Form of Quenched-Arc Switch." Mr. L. C. Grant.

(Mersey and North Wales (Liverpool) Centre).—Monday, January 20th. University, Liverpool. 7 p.m. Joint meeting with the Liverpool Engineering Society. Discussion on "Low Temperature Carbonisation of Fuel with Special Reference to its Combination with the Production of Electricity." Messrs. E. H. Smythe, E. G. Weeks, S. McEwen, and Prof. P. Rosin.

(North-Midland Centre).—Tuesday, January 21st. Albert Hall, Leeds. 7.30 p.m. Faraday Lecture. B" roadcasting by Electric Waves." Capt. P. P. Eckersley.

(South-Midland Centre).—Monday, January 20th. University, Birmingham. 7 p.m. "Recent Developments in the Protection of 3-phase Transmission Lines and Feeders." Mr. T. W. Ross and Mr. H. G. Bell.

(East-Midland Sub-Centre).—Tuesday, January 21st. The College, Loughborough. 6.45 p.m. "The Breaking Performance of High Power Switchgear and of a New Form of Quenched-Arc Switch." Mr. L. C. Grant.

(North-Eastern Students' Section).—Friday, January 24th. Armstrong College, Newcastle-on-Tyne. 7.15 p.m. "Electric Traction." Lt.-Col. H. E. O'Brien.

(Scottish Students' Section).—Tuesday, January 21st Heriot-Watt College, Edinburgh. 7.15 p.m. "Power Station Operation." Mr. J. Eccles.

(North-Western Centre).—Tuesday, January 21st. Engineers' Club, Manchester. 7 p.m. "The Analysis and Measurement of the Noise Emitted by Machinery." Mr. B. A. G. Churcher and Mr. A. J. King.

Physical Society.—Friday, January 24th. Imperial College of Science, South Kensington, S.W. 5 p.m. Ordinary meeting.

Birmingham Electric Club.—Friday, January 24th. Grand Hotel. 7 p.m. Presidential address.

Junior Institution of Engineers.—Friday, January 24th. 39, Victoria Street, S.W. 7.30 p.m. "Refractories for Steam Raising Furnaces." Mr. W. J. Rees.

Institution of Mechanical Engineers.—Friday, January 24th. Institution, Storey's Gate, S.W. 6 p.m. "General operating Experiences with the First 'Wood' Steam Generator." Mr. E. Watson Smyth.

The "Electrical Review" Service Department.

INQUIRIES must be accompanied by a stamped addressed envelope.

We shall be glad to learn the names and addresses of makers of the following:—

LINAC accessories.

SAMSON irons.

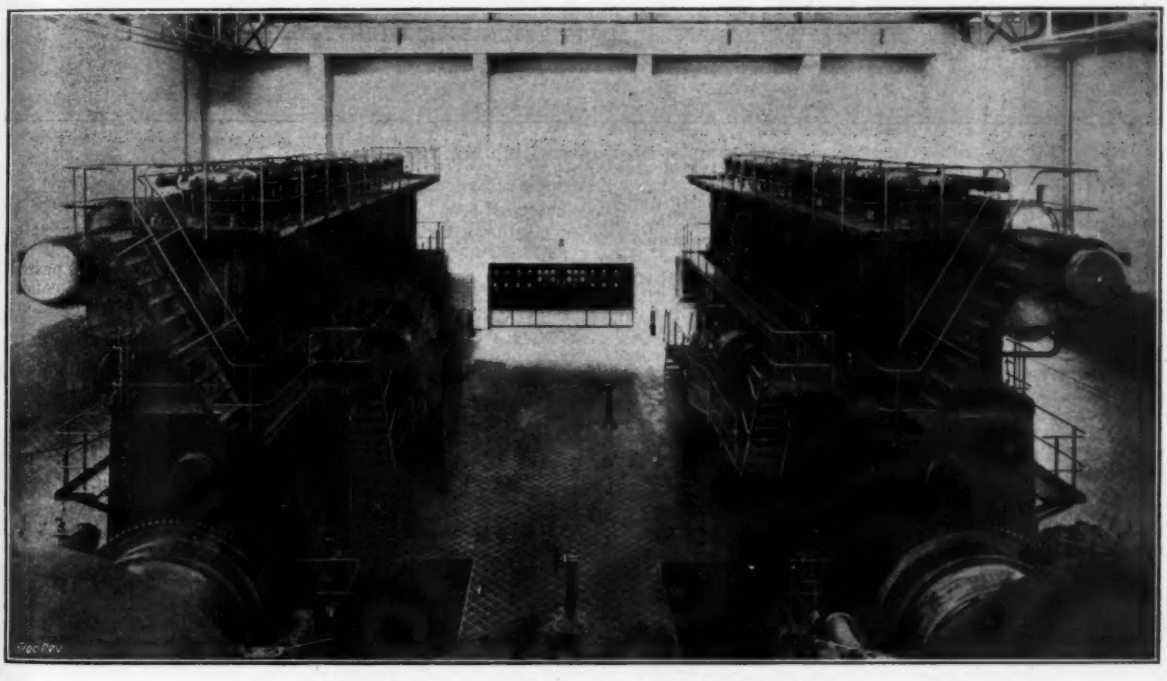
OMA lamps.

Current leakage detectors (ohmmeter type) for switchboard use.

Notes.

A Large Diesel Peak-load Sub-station.

We are indebted to Messrs. John Le Boutillier, Ltd., British agents for the M.A.N. Co., for the accompanying illustration of the Henningsdorf sub-station of the Maerkischen Electricity Works A.G., Berlin. This sub-station contains, it is claimed, the largest peak-load Diesel installation in the world, consisting of two double-acting two-stroke airless-injection engines, each capable of developing 11,700 b.h.p. at 215 r.p.m. Each engine is coupled to a 7,500-kW alternator, and, deducting the power required for the scavenging blowers, the net aggregate output is 14,000 kW. The alternators,—5,250/10,500 volts—are connected to the engines through friction clutches, so that with the engines standing the generators may be employed as phase rectifiers. For meeting pead loads promptly the starting equipment is controlled by a single-hand wheel requiring the service of only one attendant. In the case of total failure of the electricity supply the Diesel engines are started up by compressed air, proper means being also provided for the engine-room auxiliaries—such as turbo-blowers, cooling-water pumps, and lubricating-oil pumps—to be started up simultaneously.



7,500-kW Diesel Sets at Henningsdorf Sub-station.

B.S.S. for Steam Turbines and for Aluminium Conductors.

The British Engineering Standards Association has recently issued Specifications Nos. 132-1930 and 215-1930, both of which are revisions of earlier specifications. The former specification, for steam turbines, a revision of the 1920 edition, has been in preparation for several years, the work having been carried out in parallel with the International Specification for Steam Turbines by the International Electrotechnical Commission. It is interesting to note that so close has been the co-operation between the British and the International Committees that the new edition is, to all intents and purposes, identical with the International Specification as tentatively agreed by the I.E.C. Advisory Committee at its meeting in London in July last. It is also of interest to note that, whereas the 1920 edition of the specification was confined to steam turbines for electrical plant, the new specification is not so restricted. Considerable attention has been paid by the Committee responsible for this specification to the list of recommended standard ratings, an endeavour having been made to restrict the standard sizes to the fewest possible number. In this matter the Committee has had the advantage of the close co-operation of the Electricity Commissioners in so far as home requirements are concerned, the result being that the list of standard ratings, although given only as a recommendation, represents a thoroughly practical series of sizes for home and export purposes.

Specification No. 215-1930, for aluminium and steel-cored aluminium conductors for overhead lines, is a revision of the 1925 edition, and differs from its predecessor mainly in that the value of the resistivity has been slightly altered in order to conform to the value recently adopted by the International Electrotechnical Commission; the tables given in the specification have been recalculated in accordance with the new value of the resistivity. Provision has also been made for certain of the mechanical tests to be carried out, both before and after stranding. Slight modifications have also been made in the galvanising test.

Copies of both the above specifications may be obtained from the Publications Department, British Engineering Standards Association, 28, Victoria Street, S.W.1, price 2s. 2d. each post free.

Legal.

ELECTRIC LAMP FRAUDS.—At West Riding Quarter Sessions, at Leeds, on January 9th, John D. Whitaker, Wibsey, Bradford, was sentenced to 18 months' hard labour for obtaining 151 electric lamps by fraud at Halifax; and Martin Hewitt, journeyman electrician, Bradford, who was jointly charged with Whitaker, was sent to 12 months' hard labour. The charges concerned the obtaining of lamps from the Wholesale Electric Supply Stores, Ltd., Halifax, and from Frank Hirst, Dewsbury. The lamps in both cases were ordered by telephone, in the name of customers well-known to the suppliers.

Tests on Domestic Boiler Fuels.

Canada's resources in fuel are abundant, but the distribution is unfortunate. Ontario and Quebec rely largely on anthracite from the United States. This dependence has been inconvenient in recent years owing to recurrent shortages, and many substitutes have been tried. In order to determine the relative value of these, the Dominion Department of Mines has instituted a series of "Comparative tests of various fuels when burned in a domestic hot-water boiler," reported by E. S. Malloch and C. E. Baltzer (Report No. 705. Ottawa: F. A. Acland, 1929, 20 cents). These tests were carried out with great elaboration, and on thirty fuels of the most varied type, ranging from anthracite to peat, consumed in a typical domestic appli-

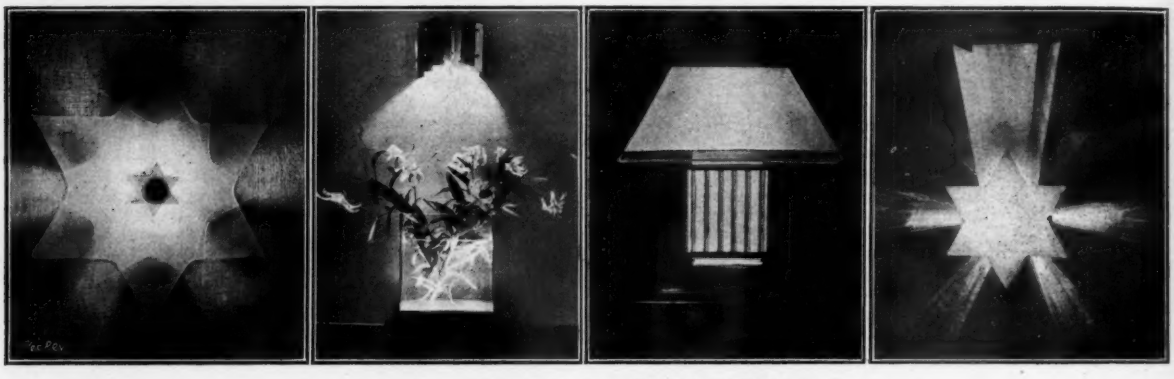
ance and for house-heating. The most efficient fuel tested was Welsh anthracite, 8.4 tons of which was equal to 10 tons of American anthracite, taken as standard. Scotch semi-anthracite was nearly as good. The tests showed that more than 70 per cent. of the heat of anthracites and cokes could be transferred to the water. With semi-bituminous coals 65 per cent., and with low-grade fuel less than 55 per cent. of the heating value of the fuel could be utilised. The results should be very encouraging to those interested in the export of British coals.—*Nature.*

Modern Artistic Lighting Fittings.

The design of lighting fittings to satisfy the æsthetic taste often involves the sacrifice of the practical side, but Mr. J. B. Gold of Messrs. J. B. Gold and S. R. Miller, architects, who has been engaged by Messrs. Marshall & Lupton, 14, Davies Street, Berkeley Square, W.1, to design artistic lighting fittings, has succeeded in fulfilling both the æsthetic and the practical purposes, and among the many models designed by him are wall brackets, standards, ceiling fittings, and

the cable throws a switch, turns on a light, sounds a signal, and does many things which formerly required a direct button or switch contact at a given stationary point. In other words, the cable is one continuous switch along its entire length, whether it be a few feet or many miles. The uses to which this cable may be put appear limitless.

Another remarkable electrical invention was also shown. This is a small grid glow tube no larger than an ordinary electric lamp. It is a very sensitive relay or, in other words, a device which operates on an infinitesimally small amount of energy, yet controlling a far greater amount. With it a very small fraction of a watt is sufficient to operate and control a power 100,000,000 times as great. To demonstrate its phenomenal ability, a small aeroplane was suspended at the stand, this having three motor-driven propellers. These were connected by wire to the tube, and when a spectator placed his hand near the latter, the electrical energy radiating from his body caused a stimulus which was stepped up sufficiently to start the motors of the aeroplane; this invention is by Mr. D. D. Knowles.



Some Examples of Modern Lighting Fittings.

cleverly arranged devices for illuminating porcelain, glass and flowers. The accompanying illustrations show four of the numerous original designs displayed in the showrooms of Messrs. Marshall & Lupton, from which it will be seen that a pleasing effect is obtained without the loss of efficiency. The examples shown are a star ceiling fitting, a wall fitting for illuminating flowers, porcelain, &c., a table lamp in silver and black fitted for two lamps, and a comet wall bracket. Mr. A. Lupton is the electrical engineer managing the Lighting Fittings Department of Messrs. Marshall & Lupton.

Novelties at a New York Exhibition.

Among the new inventions that promise to revolutionise the near and remote machine control of electrical machinery is a device which was displayed at the recent Exposition of Power and Mechanical Engineering, New York. This is the "Bishop" contact cable which consists of a waterproof, dustproof cable, impervious to acid and other forms of decay, and which, in diameter, is about the same as an ordinary lead pencil. When compressed at any point of its entire length,

Institution of Electrical Engineers.

GRADUATESHIP EXAMINATION.—The results of the graduateship examination held in November, 1929, show that 69 successful candidates passed the whole examination; 12 passed Part I only, and 4 passed Part II only. The lists of candidates who sat for the examination abroad will be issued later.

Appointments Vacant.

Electrical foreman for quay machinery at Port Sudan for Sudan Government Railways. Assistant power station superintendent for Municipality of Singapore. Foreman erector for the Government of St. Vincent. (See our advertisement pages to-day.)

Correction.

On page 8 of our issue of January 10th, in the article "Electricity in the Manufacture of Cement," the two 3,000-kVA transformers are referred to as made by the British Electrical Engineering Co., Ltd. This should read the Brush Electrical Engineering Co., Ltd.

Our Personal Column.

Electrical men are invited to enable us to keep readers of the "Electrical Review" posted concerning their movements.

Mr. A. M. MANIGHETTI, A.M.I.E.E., has been appointed Continental technical representative for the Sterling Varnish Co., of Trafford Park, Manchester. He is leaving England for the Continent on January 20th.

The telephone numbers of Messrs. HIGHFIELD & ROGER SMITH have been altered to Victoria 2946-47.

The Glasgow Electricity Committee, after hearing a report by the manager on the work at present being carried out by Mr. HUGH TURNER in connection with the supervision of electrical installations under the Cinematograph Act, &c., recommend that he be promoted from grade J9 to grade J8 of the N.J.B. Schedule at a salary of £412 per annum.

Mr. C. L. FISHER, director of the Hydro-Electric Securities Corporation, has been elected a director of the Standard Gas and Electric Co., and the Standard Power and Light Corporation.

Mr. CYRIL EDWARD LLOYD has joined the board of Associated Electrical Industries, Ltd.

At a meeting of the West Midlands District Industrial Council for the Electricity Supply Industry, on January 6th, Mr. G. R. J. Parkinson, the chairman, mentioned that that was the last meeting of the Council which Mr. R. A. CHATTOCK, who was a former chairman, would attend as a member. He paid a tribute to Mr. Chattock for his work on the Council, and this was supported by Councillor R. F. Dempster for the Trade Union side.

At last week's ordinary meeting of the Institution of Electrical Engineers, it was announced that Sir RICHARD T. GLAZEBROOK, K.C.B., D.Sc., F.R.S., had been elected an honorary member of the Institution.

The Southwark Borough Council Appointments Committee recommends the promotion of Mr. J. HOLCROFT to the position of station superintendent at a salary of £346 per annum, rising by two annual increments to a maximum of £464.

Mr. W. HOLMES, until recently electrical engineer at Barking, was, on January 8th, presented by the staff of the Urban Council with a silver tea service and a tankard.

As we reported last week, Mr. W. J. MARSTON has been appointed to succeed Mr. G. Tough, who is retiring, as electrical engineer to the Coventry Corporation Electricity Department. Mr. Marston has been associated with the Department, with the exception of a short period at Eccles, for nearly 32 years, having successively held the positions of senior charge engineer, mains engineer, outside superintendent, chief assistant and deputy engineer, and has served under Mr. Tough since 1911. The salary attaching to the appointment is £1,150 per annum.

We regret to learn that Mr. A. MURRAY COOMBS, M.I.E.E., is at present in the Putney Hospital Home, suffering from infection contracted at his home in Brighton, where a serious epidemic has occurred due to unclean milk. He has been ill nearly three weeks.

SIR THOMAS O. CALLENDER is on his way to South Africa. The accompanying picture shows him with Lady Callender

Sir Thomas O. Callender,
Who is visiting South Africa.

and friends at Waterloo Station prior to his departure on January 10th.

The Edison Medal of the American Institute of Electrical Engineers has been awarded to Professor Charles F. Scott, of New Haven, "for his contributions to the science and art of polyphase transmission of electrical energy." Professor Scott, who was born in 1864, is now professor of Electrical Engineering at Yale University, and was for 23 years associated with the Westinghouse Electric & Manufacturing Co. He is best known for his "Scott" or "T" transformer connection, which he devised in 1894.

Mr. G. G. L. PREECE, A.M.I.E.E., until recently manager in the Manchester district for Messrs. Bruce Peebles & Co., Ltd., has been appointed to the position of sales manager for England and Wales.

Congratulations to Mr. WALTER T. DUNN, M.I.Mech.E., F.C.I.S., ex-secretary of the Chartered Institution of Gas Engineers, and formerly secretary of the Junior Institution of Engineers, and to Miss Florence Price, of the Chief Engineer's staff of the Charing Cross Electricity Supply Co., Ltd., on their engagement. The marriage will take place shortly.

Mr. J. SPEIGHT, the engineer and manager of the Ormskirk Electric Supply Co., Ltd., who has been with the company since its formation about 17 years ago, has retired.

Mr. C. E. D. GREENHALGH, chief assistant electrical engineer at Watford, who is leaving to become engineer and manager of the Ilkley electricity undertaking, was on January 9th presented by his colleagues with an inscribed oak grandmother clock with Westminster chimes, the gift being handed over by the chairman of the Corporation Electricity Committee, Mr. H. Coates. Mr. Greenhalgh also received a silver cigarette case from friends in the generating station.

The Hull City Council has adopted the following recommendations by Mr. J. N. WAITE, the city electrical engineer:—Mr. G. A. VOWLES, personal engineering assistant, raised from Grade 3 to Grade 2 at £620 per annum; Mr. D. BELLAMY, commercial assistant, to be placed in Grade 3 (salary £564); Mr. H. MALLALIEU, mains engineer, Grade 4, promoted to distribution engineer, Grade 3 (£564); Mr. A. V. STANIFORTH, construction engineer and chief draughtsman, from Grade 5 to Grade 4 (£516); Mr. G. W. MITCHELL, senior mains assistant, from Grade 7 to Grade 6 (£430); and Mr. R. E. MOORE, sub-station engineer, from Grade 8b to Grade 7 (£388). The report contained further recommendations with regard to other members of the staff, and the whole of the recommendations involved an increase in the salary list of approximately £1,000 per annum.

At a recent meeting of Worcester City Council, Ald. Roberts congratulated Mr. SHAW, electrical engineer, on the twenty-fifth anniversary of his appointment.

In our last issue, relying upon a statement reported to have been made at a meeting of the Académie des Sciences, Paris, we announced the death of Professor A. A. MICHELSON. We are pleased to state that the report was unfounded, and that Professor Michelson is at present on holiday in Bermuda.

Obituary.—DR. S. Z. DE FERRANTI.—We deeply regret to record the death, at Zurich on Monday last, of Dr. S. Z. de Ferranti, F.R.S., one of the leaders of the British electrical industry from its earliest days. He was 65 years of age. An account of his career will appear in our next issue.

Herr O. NUSSBAUMER.—The *Daily Telegraph* reports the death, at the age of 54, in Salzburg, of Herr Otto Nussbaumer, an Austrian engineer, who claimed to be the inventor of the wireless telephone and was also believed to have built the "first crystal receiving apparatus for broadcast listeners."

MR. C. ADAMS.—The death occurred recently of Mr. Charles Adams, of the firm of Adams & Sons, general engineers, Harrow. Mr. Adams, who was 73 years of age, was formerly with Willans & Robinson, Rugby, and the Harrow Electric Light and Power Co., Ltd.

MR. F. H. BILLOWS.—The death occurred recently at Westcliff-on-Sea of Mr. Frederick Humphrey Billows, J.P., who was for many years a superintendent with the Indo-European Telegraph Co. He spent some years in Russia for the company.

Dr. F. BLAU.—The death occurred in Berlin on December 5th, at the age of 64 years, of Dr. Fritz Blau of the Osram Gesellschaft. The deceased was a leading German authority on electric lamps and was well-known for his work in connection with the development of the gasfilled lamp.

PROFESSOR A. RATEAU.—The Paris correspondent of *The Times* reports that the death occurred in Paris, on January 13th, of Professor Auguste Rateau, a French engineer who played a great part in the development of turbines. In the field of aviation he invented the turbo-compressor which bears his name and which permits aeroplanes to reach great altitudes. He was Inspector-General of Mines and a member of the French Academy of Sciences.

Financial Section.

New Companies, Returns of Share Capital, Debenture Charges, Reports of Electrical Companies Dividend Charges, Transactions in Stocks and Shares.

New Companies Registered.

Corolectric, Ltd.—Private company. Registered January 8th. Capital £1,000 in £1 shares. Objects: To carry on the business of electricians, wireless, electrical, mechanical and general engineers, dealers in and installers of electrical, telegraphic, wireless, photographic, theatrical, kinematographic and sound producing or recording apparatus, &c. The subscribers (each with one share) are:—D. S. Paterson, 51, Perham Road, W.14, director of a film company; W. Townsend, 17, Ravenstone Street, Balham, S.W.12, clerk. The first directors are to be appointed by the subscribers. Secretary: D. S. Paterson. Registered office: 12, Regent Street, S.W.1.

Scaife & Rudd, Ltd.—Private company. Registered January 4th. Capital, £850 in £1 shares. Objects: To carry on the business of manufacturers and importers of and dealers in lamp shades in silk and/or any other materials for electrical, gas, or other fittings, &c. The permanent directors are: H. E. Rudd, 132, Hoe Street, Walthamstow, E.17; A. W. G. Scaife, 92, Markhouse Road, Walthamstow, E.17. Qualification: £50 shares. Registered office: 1a, Greenleaf Road, Walthamstow, E.17.

Small & MacDonald, Ltd.—Private company. Registered in Edinburgh on January 2nd. Capital, £1,500 in £1 shares. Objects: To carry on the business of electrical and mechanical engineers, dealers in all kinds of electrical and mechanical machinery, &c. The subscribers (each with one share) are: J. R. Small, 177, West Regent Street, Glasgow, C.2, electrical engineer; J. Grey, 40, West Nile Street, Glasgow, C.1, C.A.: J. R. Small is the first director and secretary. Registered office: 177, West Regent Street, Glasgow, C.2.

W. A. Hymas & Co., Ltd.—Private company. Registered January 4th. Capital, £1,500 in £1 shares. Objects: To acquire the business of a scientific electrical engineer carried on by W. A. Hymas, at 303, Westmount Road, Eltham, and to carry on this and the business of manufacturers of and dealers in scientific instruments and accessories, including radio goods, &c. The first directors are: W. A. Hymas, 303, Westmount Road, Eltham, scientific electrical engineer; F. Seaman, 296, Westmount Road, Eltham, newsagent (both permanent). Qualification: £100. Solicitor: Francis W. Beech, Eltham.

Irish A.E.G. Electric Co., Ltd.—Private company. Registered in Dublin on December 31st. Capital, £100 in £1 shares. Objects: To carry on the business of manufacturing and consulting electrical, gas, hydraulic, mining and mechanical engineers, &c. The subscribers (each with one share) are: J. McBreen, 88, Grosvenor Square, Rathmines, Dublin; and A. J. Browner, 28, Herbert Place, Dublin, solicitors' assistants. The first directors are not named.

Broadcast Relay Service (Clacton), Ltd.—Private company. Registered January 4th. Capital, £7,000 in £1 shares (3,500 15 per cent. participating preference and 3,500 ordinary). Objects: To acquire the business established by the Broadcast Relay Service, Ltd., at Clacton-on-Sea, and Braintree, to construct and maintain wireless signal stations for the reception or distribution of radio signals, &c. The first directors are: J. F. Powell, 34, Wellesley Road, Clacton-on-Sea (managing director); T. Warner, The Gothic, Uplands Road, Clacton-on-Sea (both permanent). Qualification: £250. Registered office: 93, Hayes Road, Clacton-on-Sea.

L. R. Supply Co., Ltd.—Private company. Registered January 9th. Capital, £100 in £1 shares. Objects: To carry on the business of dealers in wireless and electrical apparatus of all kinds, and articles for household, garden and general domestic purposes, to be sold for cash or by deferred payments, wholesale and retail ironmongers, electricians, &c. The subscribers (each with one share) are:—R. H. Barthel and E. W. Barthel, both of 11, Oat Lane, Noble Street, E.C.2, merchants. R. H. Barthel is the first director. Qualification, £1. Registered office: 11, Oat Lane, Noble Street, E.C.2.

International Lamps, Ltd.—Private company. Registered January 10th. Capital, £2,000 in £1 shares. Objects: To carry on the business of manufacturers of and dealers in electric lamps, electrical appliances and apparatus, &c. The first directors are: F. H. R. Poole and S. S. Schreiber, both of 92, Turnmill Street, E.C.1, merchants (both permanent). Registered office: 92, Turnmill Street, E.C.1.

W. Thompson, Ltd.—Private company. Registered January 13th. Capital, £1,000 in £1 shares. Objects: To carry on the business of manufacturers of and dealers in electrical equipment and appliances of all kinds, electricians, mechanical engineers, machinists, garage proprietors, &c. The directors are: W. Thompson, "Lynton," Melton Road, Syston, Leicester; R. Markham "Wannock," Wynfield Road, Leicester (both permanent subject to each holding 250 shares). Qualification: £100 shares. Secretary: R. Markham. Registered office: 40, St. Peter's Lane, Leicester.

Official Returns of Electrical Companies.

Rissik, Fraser & Co., Ltd. (formerly Rissik, Fraser, Spinks & Co., Ltd.).—H. A. Brown, Trafalgar House, Waterloo Place, Pall Mall, S.W., was appointed receiver and manager on December 24th, 1929, under powers contained in mortgage dated December 8th, 1928.

Weald Electricity Supply Co., Ltd.—Charge on "Fairview," Hawkhurst, Kent. Dated December 21st, 1929, to secure all moneys due or to become due from the company to the Westminster Bank, Ltd.

Wilkinson Bentley & Co., Ltd.—Capital £3,000 in £1 shares. Return dated September 23rd, 1929. 1,850 shares taken up. £1,850 paid. Mortgages and charges, nil.

T. C. Gilbert & Co., Ltd.—Capital £5,000 in £1 shares. Return dated September 13th, 1929. 3,200 shares taken up. £2,300 paid. £900 considered as paid. Mortgages and charges £409 16s.

C. B. Jackson & Co., Ltd.—Capital £3,000 in 1,000 preference and 2,000 ordinary shares of £1 each. Return dated September 5th, 1929. 970 preference and 1,813 ordinary shares taken up. £1,083 paid. £1,700 considered as paid. Mortgages and charges, nil.

Aron Electricity Meter, Ltd.—Capital £350,000 in £1 shares. Return dated July 22nd, 1929. 75,968 shares taken up. £75,968 considered as paid. Mortgages and charges, nil.

Rawlings Bros., Ltd.—Capital £100,000 in 30,000 preference and 70,000 ordinary shares of £1 each. Return dated August 20th, 1929. 21,185 preference and 56,244 ordinary shares taken up. £77,429 paid. Mortgages and charges, nil.

W. R. Sykes Interlocking Signal Co., Ltd.—Capital £50,000 in 87,500 "A" and 12,500 "B" shares of 10s. each. Return dated October 30th, 1929. 42,297 "A" and 12,500 "B" shares taken up. £10 513 12s. 6d. (5s. per share) paid on 42,297 "A" shares, less £60 12s. 6d. calls unpaid. £16,824 5s. considered as paid (being 10s. per share on 12,500 "B" and 5s. per share on 42,297 "A" shares). Mortgages and charges, £17,526.

Rangoon Electric Tramway & Supply Co., Ltd.—Capital £800,000 in 250,000 preference and 550,000 ordinary shares of £1 each. Return dated May 13th (filed September 3rd), 1929. 250,000 preference and 400,000 ordinary shares taken up. £585,000 paid on 250,000 preference and 335,000 ordinary shares. £65,000 considered as paid on 65,000 ordinary shares. Mortgages and charges, £346,770.

Vincent Switchgear Manufacturing Co., Ltd.—Capital £10,000 in £1 shares. Return dated September 25th, 1929. 7,948 shares taken up. £7,948 considered as paid. Mortgages and charges, nil.

Julians, of Reading, Ltd.—Capital £5,000 in £1 shares. Return dated August 6th, 1929. 2,403 shares taken up. £2,403 paid. Mortgages and charges at date of return, nil. Since registered: Mortgage dated October 1st, 1929, to secure £3,650 and further advances up to a maximum of £6,000.

C. H. Rees & Co., Ltd.—Capital £3,000 in 2,500 preference and 500 ordinary shares of £1 each. Return dated August 27th, 1929. 1,500 preference and 500 ordinary shares taken up. £3 paid. £1,997 considered as paid. Mortgages and charges, £2,500.

N.S. Accumulators, Ltd.—Particulars filed of £1,500 debentures authorised November 28th, 1929, charged on the company's undertaking and property, present and future, including uncalled capital, the amount of the present issue being £500.

Capel & Co., Ltd.—Charge on 168, Dalston Lane, E.8, dated December 18th 1929, to secure all moneys due or to become due from the company to Barclays Bank, Ltd.

Keswick Electric Light Co., Ltd.—Satisfaction to the extent of £9,550 on December 23rd, 1929, of debentures authorised May 14th, 1901, and registered July 1st, 1901, securing £10,100. (Previously satisfied £550.)

Fellows Manufacturing Co., Ltd.—P. A. Bristow, of 68½, Upper Thames Street, E.C.4, was appointed receiver and manager on January 6th, 1930, under powers contained in debentures dated November 15th, 1929.

Rheostatic Co., Ltd.—Mortgage on land at Salt Hill, Slough, dated December 20th, 1929, to secure all moneys due or to become due from the company to the District Bank, Ltd.

City Notes.

Calcutta Electric Supply Corporation, Ltd.

Lord Meston (chairman) presided at the extraordinary meeting on January 10th, called to consider proposals to maintain British control of the company. He said that, briefly, the intention was to restrict the holdings of non-British shareholders to 20 per cent. of the issued capital. The proposal had been termed "drastic"; he preferred to call it "definite," leaving no loopholes for evasion. They had as a model the resolutions passed by certain British railway companies in Argentina. There was no hardship in asking a bank to disclose the nationality of a client for whom it was acting; without this power there could be no effective restriction. The proposals were aimed at neither American nor Indian interests. Indians, being British subjects, were in no way affected. The directors did not propose to exercise the powers harshly; the interests of the individual shareholder would continue to be respected.

Last year they were informed by the Government of Bengal that it was considered essential that the control of the company should remain in British hands. It was intimated that the public authorities concerned would either have to consider the question of compulsory purchase of undertakings under concession, in accordance with the terms of the concessions, or impose a condition in the licences requiring control to be held by British or Indian interests. Since that intimation, the company had applied for a further licence in respect of a small subsidiary area, and the Government had made it clear that it intended to await the company's action in this matter before granting any new licences.

Mr. T. J. Carlyle Gifford, who said that he represented 80,000 ordinary shares held by investment trust companies, protested against the proposals. While he recognised that the directors were acting under pressure, he pointed out that Great Britain held the control of a large number of foreign countries and such proposals were injurious to this country's financial interests. Mr. H. Carlisle, who also represented a group of trust companies, maintained that it was important for the British character of the company to be preserved. The company would have to spend a great deal of money on equipment in the next few years, and unless British control was maintained, there was a danger that the orders for that plant would be lost to this country. Mr. S. Russell also supported the resolution. Col. Leveson-Gower asked the directors to consider the probable effects of the proposals on English investments abroad; Mr. L. A. Stride supported the directors, his view being that the restriction would be to the good of British industrial concerns.

The chairman said that the directors had received proxies in favour of the resolution from the holders of 1,146,232 shares and only 24,771 against. On a show of hands, the majority was insufficient to carry the resolution, and a poll was demanded. Although this will delay the matter for a few days, the directors' proposals will, of course, be given effect.

Perak River Hydro-Electric Power Co., Ltd.

A circular has been sent to the holders of the company's 7 per cent. participating debentures and shareholders stating that the consulting engineers' original estimate of additional expenditure upon construction works has been revised and the figure has been increased from £350,000 to £600,000. This represents an excess of about 50 per cent. in respect of the civil engineering work on the Chenderoh Dam and about 10 per cent. on the original estimated cost of the electrical transmission and transforming systems. In addition to this additional cost, £250,000 has been expended upon the extension of the steam station up to 18,000 kW, this amount having been obtained from the bank upon the security of 7 per cent. participating debentures. Thus a total of £850,000 is required to complete the scheme. It should be borne in mind, however, that the present scheme provides for an annual output of 160 million kWh against the original 100 million kWh. The whole cost of the scheme has now been fixed definitely at £3,166,000. The position was placed before the Government of the Federated Malay States, which has consented to advance £850,000 on loan at 5 per cent. interest. The loan will rank as a charge immediately after the first guaranteed debenture stock and will be repayable, by means of a sinking fund, at the same date as the 7 per cent. participating debenture stock. It is proposed that this date shall be postponed from June 30th, 1951, to July 31st, 1961, to lighten the annual burden of the sinking fund. The F.M.S. Government is also to be given one vote in respect of each of the 500,000 preference shares which it holds. This, together with the rights conferred by its holding of ordinary shares will give the Government voting control. After the adjourned ordinary general meeting on January 29th, extraordinary meetings will be held to consider the proposals which the directors recommend for acceptance.

Stock Exchange Notices.

Dealings in the following securities have been allowed by the Committee under Rule 159:—

Hydro-Electric Securities Corporation, Ltd., 55,367 shares of common stock of no par value.

North-West Midlands Joint Electricity Authority, £886,000 5 per cent. stock, 1950-1970, issued at £98¼ per cent., partly paid and fully-paid.

Ever-Ready Trust and Finance Co., Ltd.

The first report of this company covering the period from November 14th, 1928, to December 31st last shows a balance of £35,162, after meeting expenses and income tax, from which the following allocations have been made:—Preliminary expenses (one-third written off), £11,040; transferred to capital reserve account, £9,536. There is, therefore, a balance of £14,586 which is carried forward. The report records the retirement of Mr. W. Russell Walker from the board through ill-health.

American Commonwealth Power Corporation.

The net profit of this corporation and its subsidiaries for the year ended November 30th was $10,879,146, and the balance for dividends and reserves of the parent corporation was $4,285,141. After payment of dividends on first and second preference stocks, the balance for reserves, Federal taxes and surplus, is $3,666,459.

Associated Gas and Electric System.

The gross income for 1929 was $85,826,042, against $42,000,909 in 1928, and the net earnings amounted to $41,703,753, as compared with $18,943,912. After providing for interest, preferred dividends, depreciation, &c., the balance available for dividends and surplus is $12,962,480 ($6,214,573).

West India and Panama Telegraph Co., Ltd.

The meeting called for January 20th to consider proposals to safeguard the British control of the company, has been postponed until February 3rd.

Electrolytic Zinc Co. of Australasia.

A dividend at the rate of 12 per cent. per annum has been declared for the six months ended December 31st.

Brazilian Traction, Light, and Power Co., Ltd.

A quarterly dividend of 50 cents per share on the ordinary shares, payable on March 1st next has been declared.

Singapore Traction Co., Ltd.

The directors have recommended a dividend of 7 per cent., less tax, on the 7 per cent. cumulative preference shares.

Allen-Liversidge, Ltd.

An interim dividend of 4 per cent. has been declared on the ordinary shares.

Stocks and Shares.

TUESDAY EVENING.

THE cheapness of money, to which attention was drawn here last week, as being the principal reason for the strength that developed in Stock Exchange markets after the turn of the New Year, is not so pronounced as it was a few days ago. There is a general air of caution over many of the Stock Exchange markets; in certain directions, notably those connected with rubber, tin and silver, the disposition remains depressing. Moreover, the troubles in India have had a further dulling effect upon prices of companies working in the country, while political considerations in Australia have the effect of checking enterprise and capital. On the other hand, the Government's attitude, in seeking to draw together the forces of capital and labour into amicable agreement, is construed as likely to be helpful to trade.

The North-West Midlands Issue.

In spite of the readiness of money to seek Stock Exchange investments, the North-West Midlands Joint Electricity Authority 5 per cent. stock was left with underwriters to the tune of 85 per cent. The price of issue was 98¼, and as the stock does not bear the cachet of being eligible for trustee investments, the terms seem to have been considered high. The opening price of the scrip was 1¼ discount. It is assumed that when the issue settles down into the hands of the permanent investor, the course of the price will improve; there was a rally to ¾ discount early this week.

Perak River Hydro-Electric.

The Perak River Hydro-electric Power Company has been offered a loan of £850,000 by the F.M.S. Government with 5 per cent. interest, the loan to rank as a charge immediately after the first guaranteed debentures. In consideration of the loan, the F.M.S. Government requires that the company's Articles of Association shall be amended to confer voting rights on the half-million £1 preference shares, which are all held by that Government. This would give control of the company to the F.M.S. The same terms require that the date of repayment of the 7 per cent. debenture stock shall be extended to July, 1961.

The company's 5 per cent. debenture stock, mentioned above, is guaranteed under the T.F.A., and stands at 98. The 7 per cent. debenture stock is 1¼ better, at 106¼, and the ordinary shares of £1 each at 11s. No doubt the Perak Hydro-Electric Power Company shareholders will consent to the alteration of the terms, for the loan of £850,000 will certainly be very useful in enabling the company to complete its programme of construction.

Another of the T.F.A. stocks is that of the Tata Power Company, operating in India, which has a 4½ per cent. "A" debenture, guaranteed under the Acts, which stands at 93. The company's 7½ per cent. "B" mortgage debenture stock is quoted at 99.

Home Railway Strength.

The Home Railway companies are expected to declare their dividends in the near future, and the Metropolitan will lead the way with its announcement on January 30th. It was mentioned last week that the prophets look for the company to increase its distribution to 4 per cent., as against the 3½ per cent. paid for 1928. The stock has strengthened to 63, at which the yield on the money, on the 3½ per cent. dividend basis, is £5 11s. per cent. Underground Electric income bonds spurted sharply, and at 106 show a gain of 4 points, the £1 shares being better also, at 22s. Districts are 10s. higher, at 72½. The Southern Railway contemplates an ambitious programme of new works, amongst which electrification stands first. It is anticipated that the company's electrification extensions will cost nearly £600,000, and several of the newly-electrified lines will be brought into operation, it is hoped, in the course of the coming summer. The Great Western is also taking powers for work which will involve the expenditure of a good deal of money. Amongst these is the construction of a short junction at Bishop's Road, Paddington, between the company's main line and the Metropolitan Railway.

British Columbia Electric.

In Canada, where money is being spent lavishly upon hydro-electric schemes, the British Columbia Electric Railway Company has just awarded contracts running into half-a-million dollars, for the construction of the fourth generating unit of the Jordan River plant at Vancouver Island. The whole sum is to be expended within the British Empire, and, apart from this, a substantial amount of money will be required for installing the equipment.

Dollar Stocks.

Brazilian Tractions are one of the lively speculative counters of the moment in the Stock Exchange, and the price, after a dip to 37½, went above 40, reverting later to the latter figure. A meeting is to be held in Toronto on the fourth of next month for the purpose of passing a resolution that will authorise the company to apply for power to declare stock dividends. The tendency of American stocks and shares has been a little irregular. Montreal Light & Power, at 134½, are ½ lower; Pennsylvania Water, at 77½, have gained a dollar; and Power Corporation of Canada, at 76½, are similarly down. Shawinigan Water, at 82½, show a gain of 2 points. Consolidated Gas, Electric Light & Power of Baltimore are steady at 97½, and Canadian General Electrics are officially quoted at the extremely wide margin of 250 to 300. Hydro-Electrics spurted to 42½. Mexican Light & Power shares have fallen abruptly, and at 68½ show a fall of 6½. The other shares of the company remain unchanged, however, nor is there any alteration worth mentioning in Mexico Tramway shares, the price of which is 30. Mexican Electric Light 5 per cent. first mortgage bonds hardened to 68, and Pachuca Light & Power firsts are better at that same price.

Indian and Other Shares.

The West India & Panama Telegraph Company has called a meeting for February 3rd, to consider alterations in the Articles of Association, the effect of which would be to keep the company under British control. This meeting has been postponed from January 20th, the date originally fixed for it. The Calcutta Electric Supply Company found some opposition to the directors' proposal that the holding of foreign shareholders should be restricted to a maximum of 20 per cent. of the total capital. On a show of hands, the necessary three-quarters majority was not obtained, but the Board held proxies overwhelmingly in favour of the scheme. Calcutta Electric Supply ordinary shares have improved to 48s. 3d., being a gain of 2s. 6d. on the week, the preference shares remaining unchanged at £1. Delhi Electric Supply & Traction ordinary, at 38s. 6d., continue dull. Calcutta Trams are unchanged at 14s.

British Electricity Supply.

The market for electricity supply shares is generally firm. A sharp rise in County of London ordinary stands out as the prominent feature, the price having risen 3s. to 45s. London Electrics recovered their slight fall of last week. In the Provincial group, improvements have occurred in Yorkshire Electric, Newcastle-upon-Tyne preference, Midland Counties ordinary, and Clyde Valley shares. British Power & Light recovered to 14s. Egham & Staines are hard at 32s., and Northamptons at 44s. Richmond Electrics remain at £2 2s., North Metropolitans are 2½. Isle of Thanet only rose to 31s. Of the new issues, Metropolitans, now fully paid, are quoted at 36s. 6d., and County of London ordinary rose a shilling to 7s. premium. A good deal of business is going on in this department, and, although the changes are comparatively modest, day by day they reflect the growing disposition on the part of the investor to increase his stock in the industry which, more than any other, is regarded as likely to go ahead materially during the current year.

The Manufacturing Companies.

Shares in the manufacturing companies are also being bought. Enfields have risen to 6, British Insulated have been in persistent demand up to £4 per share. It may be recalled that some time ago a hint was repeated here to the effect that, either this year or next, it would not be surprising if the company were to issue fresh shares at a price that would give a bonus to proprietors. The amount of floating supply of good-class shares in this market is comparatively meagre. Edison Swan 5 per cent. debenture stock shows a gain of 2 at 84½, business having been done up to 86½. The company's 3½ per cent. second debenture stands at 86. The first preference shares remain at 24s 6d. Crompton Parkinson ordinary are better at 20s. 9d. A little demand for Telegraph Constructions sufficed to raise the price £1 to 24. In this last case the market is so restricted that an order in a mere handful of shares is sufficient to bring about a change in the quotation. Associated Electrical Industries ordinary shares are better at 27s. 6d.

Telegraphs and Telephones.

Cables & Wireless "A" ordinary is 1½ higher at 76½, no heed being paid to the reported boast of the Western Union Telegraph president that "the American communication services hold the British monopoly in the hollow of their hand." American Telephone & Telegraph capital stock is 2 lower at 224; International Telegraphs are equally down at 75. Great Northern Telegraphs have risen 15s. to 30½. Anglo-American 6 per cent. preferred strengthened to 102½.

Marconi Marines are 2s. 6d. higher at 2⅞ on dividend hopes. Canadian Marconis are neglected at 16s. 3d. Rubber shares gave way on a drop to 7½ per lb. in the raw material. In the iron and steel section, Vickers rose to 9s., but returned to 8s. 9d. Buying of Babcock & Wilcox lifted the price to £3 middle.

Share List of Electrical Companies.

	Nom.	Approx. Dividend. 1927.	1928.	Price Jan. 14 1929.	Rise or fall	Yield p.c.
HOME ELECTRICITY COMPANIES.						
Bournemouth and Poole	£1	15	15	57/6	—	5 4 4
Brompton Ordinary	£1	8½	8½	25/6	—	6 9 10
Charing Cross Ordinary	£1	8½	8½	26/-	—	6 7 8
do. do. 4½% Pref.	£1	4½	4½	17/-	—	5 6 0
Chelsea	£1	8¾	8¾	25/-	—	6 12 0
City of London	£1	10	10	39/-	—	4 7 6
do. do. 6% Pref.	£1	6	6	22/6	—	5 6 8
Clyde Valley	£1	8	8	35/9	+9d.	4 9 6
County of London	£1	7	10	45/-	+8/-	4 9 0
do. do. 6% Pref.	£1	6	6	22/-	—	5 9 8
Edmundson's 7% Pref.	£1	7	7	34/-	—	5 16 8
Elec. Supply Corporation	£1	11	11	47/-	—	4 13 7
Kensington Ordinary	£1	8	8	26/-	—	6 7 8
Lancs. Light and Power	£1	7½	7½	27/-	—6d.	5 11 1
London Electric	£1	8½	9	26/6	+6d.	5 5 8
Metropolitan	£1	9	9	36/3	—	4 19 4
do. 4½% Pref.	£1	4½	4½	17/-	—	5 6 0
Midland Counties	£1	6½	6½	28/-	+1/-	4 12 10
Mid. Elec. Power	£1	15	8	33/9	—	4 14 10
Newcastle-on-Tyne Ordinary	£1	6	6	23/9	—	5 1 1
do. 7% Pref.	£1	7	7	25/6	+6d.	5 9 10
Notting Hill 6% Pref.	£10	6	6	10½	—	5 11 4
North Met. Elec. 6% Pref.	£1	6	6	22/-	—	5 9 1
St. James' and Pall Mall	£1	8	8	25/-	- 1/-	5 12 0
Scottish Power	£1	8	8	29/-	—	5 12 8
South London	£1	8½	8½	25/6	—	5 9 10
Urban Ordinary	£1	7	7	33/9	—	4 3 0
Victoria Falls Ord.	£1	15	15	3	+⅛	5 0 0
Westminster Ordinary	£1	8½	8½	25/-	—	5 19 0
Whitehall Elec. Invst. 7½% Pref.	£1	7½	7½	23/6	—	6 7 8
Yorkshire Elec.	£1	8	8	32/6	+6d.	4 18 8
HOME RAILS.						
Central London Ord. Assented	Stock	4	4	71	—	5 12 8
Metropolitan	£	8	8½	63	+½	5 11 0
do. District	£	4	5	72½	+½	6 18 0
Underground Electric	£1	5	7	22/-	+1/-	6 7 8
do. do. Income	Bonds	6	6	106	+4	5 13 2
TELEGRAPHS AND TELEPHONES.						
Anglo-Am. Tel. Pref.	Stock	8	8	102½	+1	5 17 8
do. Def.	£	1½	1½	24⅜	—	6 4 5
Automatic Telephone	£1	10	12½	37/6	—	6 13 4
Cables & Wireless 5½ Pref.	Stock	—	—	90	—	5 11 0
do. A 7½ Ord.	£	—	—	76½	+1	... ...
do. B Ord.	£	—	—	87½	—	... ...
Globe Tel. and T. Ord.	£10	10	10	23	—	*4 7 0
do. do. Pref.	£10	6	6	11	—	5 9 1
Great Northern Tel.	£10	20	20	30½	+½	6 11 2
Indo-European	£5	10	10	52½	—	*3 16 2
Marconi-Marine	£1	12½	15	2⅜	+⅛	... ...
Oriental Telephone Ord	£1	12	12	21½	—	*4 5 5
HOME AND FOREIGN TRAMS, &c.						
Anglo-Arg. Trams First Pref.	£5	5½	5½	8 1/16	+1/16	8 19 6
do. do. 2nd Pref.	£5	6	6	8	—	10 0 0
do. do. 5% Deb.	Stock	5	5	71½	—	6 19 10
British Electric Traction Def. Ord.	£	5	5	15/6	—	... ...
do. do. Pref. Ord.	£	8	8	121½	—	6 11 9
Brazil Traction	£100	7	8	40	+1½	5 0 0
Brit. Columbia Elec. Rly. Pcc.	Stock	5	5	87½xd	—	5 14 8
London & Sub. Trac. 5% Pref.	£1	Nil	Nil	10/6	+6d.	... ...
London United Tram Deb.	Stock	4	4	50½xd	—	7 18 0
Mexico Trams, 5% Bonds	—	5	5	66½	—	7 10 5
Mexican Light Common	£100	Nil	Nil	68½	—6½	... ...
do. 7% Pref.	£100	7	7	72½	—2	9 13 2
do. 1st Bonds	—	5	5	71½	—	6 14 3
Yorkshire (West Riding)		Nil	Nil	8/-	—	... ...
MANUFACTURING COMPANIES.						
Assoc. Elec. Ord.	£1	6	—	27/6	+6d.	4 8 0
Babcock & Wilcox	£1	12	15	3	+⅛	*5 0 0
British Aluminium Ord.	£1	10	10	46/-	—	*4 7 0
British Elec. Transformer Pref.	£1	7	7	10/-	—	... ...
British Insulated Ord.	£1	15	15	3½	—⅛	3 17 4
Brush Ord.	Stock	10	10	126½	—	7 18 1
Callenders	£1	15	15	3⅜	—	4 2 8
do. 6½% Pref.	£1	6½	6½	1½	—	5 4 8
Crompton Parkinson Ord.	£5/-	—	20	20/9	+9d.	7 4 3
do. 8% Pref.	£1	8	8	26/-	—	6 8 0
Edison-Swan 1st Pref.	£1	7½	7½	24/6	—	7 1 2
do. 5% Deb.	Stock	5	5	84½	+2	5 18 4
Electric Construction	£1	7½	6½	15/-	—	7 6 8
Enfield Cable Ord.	£1	20	20	4½	—	4 2 0
English Electric	£1	Nil	Nil	5/-	—	... ...
do. do. Pref.	£1	8	Nil	7/6	—	... ...
Gen. Elec. Pref.	£1	6½	6½	24/-	—	5 8 4
do. Ord.	£1	10	10	2 7/16	—	4 6 7
Henley	£1	25	30	6	+⅛	5 0 0
do. 4½% Pref.	£5	4½	4½	4½	—	5 6 0
India-Rubber	£1	Nil	Nil	11/3	—	... ...
Johnson & Phillips	£1	10	—	26/3	—	5 10 3
Siemens Ord.	£1	7½	7½	25/-	—	6 0 0
Telegraph Construction	£2	10	16	24	+1	*5 0 2

*Dividends paid free of Income Tax.

Radio Apparatus in Italy.

Importation and Manufacture.

THE *Industrie und Handels-Zeitung*, of Berlin, has recently made a special report regarding the progress of the manufacture in Italy of wireless material, that country's export trade in such goods, and more especially its dependence on imported material for a large portion of its requirements. It is shown that Italy still purchases abroad 75 per cent. of its total needs of wireless apparatus and accessories. Although manufacture is undoubtedly increasing there will be a large market for imported goods of this nature for a considerable time, more particularly in view of the growing popularity of "listening-in."

At present there are six transmitting stations in operation and two are under construction, one at Rome of a wave-length not yet decided and of 50-kW power and a short-wave station, also in Rome, with a power of 12 kW. Within the next two years it is proposed to erect another at Palermo (209.8 metres and 3 kW), and one at Trieste (256.4 metres and 7 kW). When the new large installations are in operation the present transmitting stations will go out of use.

The broadcasting system is controlled by a concern known as the E.I.A.R., a company with a capital of 10,250,000 lire, conjointly with a special committee. The income of the company consists of the licence fees paid by subscribers, the fees made obligatory on local authorities, hotels, picture palaces, clubs and bathing resorts, together with 90 per cent. of the proceeds of the Government tax on wireless articles. It is doubted, however, whether the company's income covers its expenditure. Since the E.I.A.R. took over the control of the transmitting stations there has been a marked improvement in the programmes.

Radio apparatus manufacturers and traders are required to take out an annual licence for which a charge of 100 lire is made. With the licence is delivered a stock book in which all incoming and outgoing deliveries of radio apparatus and parts subject to tax are entered. In addition to the usual turnover tax and import charges, a special tax is levied on many of these goods. Every wireless shop and factory has to bear a plate showing that it is an authorised establishment.

Among Italian manufacturers of radio goods are: The R.A.M., of Milan, which makes these articles exclusively and employs about 200 workpeople in an up-to-date factory; the S.I.T.I. and Ansaldo-Lorenz concerns, of Genoa, which make them as side lines; the Fiat Company, of Turin, and Marelli, of Milan, which are about to add this branch of manufacture to their activities; the Marconi Company, of Genoa; the Standard Electric Italiana, of Milan; the S.A.F.R., of Milan, which makes loud-speakers and earphones and exports to South America; the S.S.A., of Bologna, and the Unda Toblach, which make condensers and parts; the Edison Clerici, of Milan, and the Zenith Company, of Monza, making valves; and the Allocchio Bacchini, of Milan, which supplies the army.

The United States, by reason of its intensive propaganda and well-organised sales service, holds first place amongst importers of radio apparatus, although its products are the most expensive on the market. Holland is represented by the Philips concern's own branch in Milan, with assembly and repair shops, and the Telefunken has a similar organisation, also in Milan. These two concerns cater for the middle-class trade. The remainder of the import business is shared amongst other German, French, Austrian, and English firms. The demand for headphones has declined owing to the increasing vogue of loud-speakers. In the last named the United States has had the greater part of the trade in recent years, but latterly the other importing countries have gained some success in this branch. At the same time, local competition has grown very keen. The business in parts is divided between Germany and the United States, with the S.S.R., of Bologna, showing great competitive power.

The Philips and Telefunken concerns control the business in valves, in which local manufacture is still rather behind hand. Italian makers supply the army and navy, which have to give preference to national manufactures. Owing to the keen competition amongst importers from various countries a system of liberal discounts is in vogue.

Imports during the first seven months of last year amounted to 512 tons and exports to less than 17 tons. In 1928, for which full details are available, imports amounted to 312 tons, valued at 30,250,000 lire, as against 147 tons, valued at 18,711,000 lire, in the preceding year.

Proposed New Egyptian Tariff.

In our last issue (p. 81) we gave particulars of the new duties on electrical apparatus which the Egyptian Government proposes to impose as a part of the general tariff revision. In addition to the goods set out in our article, the complete schedule published with the *Board of Trade Journal* for January 9th, includes the following items:—"Electric meters and apparatus of all kinds for measuring electricity," 15 per cent. *ad valorem*; "tramway cars, traction or trailer, furnished or not," 1,200 millièmes per 100 kg.

French Electrical Industry and Trade.

A Manufacturers' Association Survey.

AT the recent congress of the French Association for Economic Expansion a delegate from the Electrical Manufacturers' Association gave an interesting review of the progress of the electro-technical industry in France. He said that in 1913 only about 300,000,000 fr. was invested in this industry and its turnover was valued at about the same figure. At present, however, it employs 100,000 workpeople and the invested capital has risen to 2,500,000,000 fr., with an annual turnover of 4,000,000,000 fr. Of this total, exports represent 450,000,000 fr., or about 11.25 per cent., a much lower percentage than before the war when 17 per cent. was exported. At the same time there is an absolute increase in the value of electrical exports of 100 per cent. Of the total export trade last year 24.3 per cent. consisted of electro-dynamic machines and 21.2 per cent. of apparatus and electro-technical material. The French colonies are the principal customers and take one quarter of the total shipments. Then in order of importance come Belgium, England, Spain, and Italy. For the first nine months of 1929 an increase compared with the previous year of only 6.9 per cent. was recorded, which showed a slackening in the rate of progress compared with recent years. At the same time exports have been greater than imports, although for the first nine months of 1929 there was an advance in imports of 35 per cent., the total value during that period being 407,000,000 fr., this movement being attributable to large supplies on reparation account.

French electrical manufacturers complain of a very unfavourable tendency in their costs of production. Since the spring of 1926 wages have risen by 50 per cent., and raw materials and metal by between 17 and 34 per cent., while taxation now amounts to 18 per cent. of the annual turnover. Consequently rationalisation and standardisation schemes will be necessary. The French manufacturers have not yet asked for any increase in import duties, but fear that they will be forced to do so in the future and on that account are against the project of a tariff truce. The home market seems capable of great development as the electrification of the country districts is backward. On January 1st, 1928, out of 38,000 communes only 21,000 were provided with electricity. The railway electrification programme drawn up in 1920 provided for the conversion of 9,000 km. of line, but up to the present only 1,400 km. has been electrified.

Industrial Realities.

An Address by the Director of the B.E.A.

THE first informal monthly luncheon meeting of the year was held by the British Engineers' Association at St. Ermin's Restaurant, S.W., on Thursday last week.

Sir GILBERT C. VYLE, the president, occupied the chair, and an address was given by Mr. D. A. BREMNER, O.B.E., director of the Association, on "The Realities of the Industrial Situation." Mr. Bremner commenced his address by saying that British industry was face to face with a very serious situation and it was of no use thinking that it could "muddle through" when it had to meet very highly trained foreign competitors. The problem of to-day was not production—we could produce all that was required—but consumption. It was necessary to find customers with the necessary money to pay for the goods. However disinclined industrialists had been in the past to give their attention to economic matters and the monetary system they would have to study such matters now if they were to succeed. Credit, especially, which affected all engaged in industry and commerce, must receive their closest consideration. In the matter of tariffs this country was in a peculiar position. Although in 1928 we collected more in Customs duties than any other country, the protection afforded by our tariff was extended to only 6 per cent. of the industries of the country. We were, however, awakening to the real condition of affairs, and there was growing opposition of the proposed "tariff truce" which could not possibly bring any benefit to this country. A tariff was imposed either for revenue purposes or for the protection of industries. The abolition of duties would mean increased taxation to make up the loss. Tariffs were usually part of a well-thought-out scheme of economic nationalism, and those countries which had instituted tariffs would not abolish them to satisfy a dead theory of free trade. Any talk of Imperial trade development was useless if the tariff question was neglected. The Dominions adopted a purely business-like attitude, and they would certainly refuse to remove import duties unless we could offer them something substantial in exchange. A saner view was now being taken of unemployment, and it was realised that it was a manifestation of a disease affecting the whole of the body politic and could only be cured by a readjustment of national economic policy to modern needs; conditions were very different from what they were in Cob-

den's days. Empire development was a vital need and much was expected from the forthcoming Imperial Economic Conference, of the preparatory committee of which Sir Gilbert Vyle was chairman. This country would not extricate itself from its industrial and economic troubles while it adhered to Government by politicians. British industry must so organise itself as to play a determining part in the affairs of the country.

Mr. P. J. HANNON, M.P., in some remarks following the address, said that every community in Europe was determined to develop its resources and they all looked to England as a market for their surplus products. Our problem to-day was to educate the working classes to support a policy which would save the industries by which they lived. The outlook was not bright. India was rapidly approaching a condition of chaos, while Egypt was instituting a tariff which practically meant the exclusion of British goods. France and Italy had built up strong systems behind tariff walls; the former had reached a state of prosperity with the money which she should have paid to us.

In closing the proceedings, Sir GILBERT VYLE asked the members of the Association to study methods of influencing their employés and guiding them to a proper appreciation of the realities of the situation.

The Australian Customs Tariffs.

Higher Duties on Electrical Goods.

IN view of the importance to British electrical manufacturers and traders of the recent amendments to the Australian Customs tariffs, we reprint below extracts from the schedules of the new duties which appeared in the *Board of Trade Journal* for December 5th and 19th last. It will be observed that the import duties on electrical apparatus have been increased considerably, and while British goods are still accorded preferential treatment, in most cases the margin of preference has been reduced, *i.e.*, the preferential rate has been increased in greater proportion than the general rate. For instance, whereas the general rate on transformers has been increased by 50 per cent., the British preferential duty is over 70 per cent. higher.

The duties on radio receivers and parts were formerly 35 per cent. and 55 per cent. *ad valorem* under the preferential and general tariffs, respectively. New specific duties are imposed on each class of component. The *ad valorem* duties on complete sets are still 35 per cent. and 55 per cent., but, if they will produce more, specific duties of 20s. or 30s. per valve-holder are imposed.

It would appear that further increases in duties will be instituted at some future date. Australian manufacturers, while expressing their satisfaction at the present increases, are still anxious to see the movement continue. This view was recently put forward by the Metal Trades Section of the N.S.W. Chamber of Manufacturers in a statement typical of a number which have proceeded from manufacturers' organisations.

Tariff No. and Article.	Former Rates.		New Rates.	
	British Preferential Tariff.	General Tariff.	British Preferential Tariff.	General Tariff.
179. (B) Electric fittings consisting wholly or partly of metal, viz., switches, fuses, and lightning arrestors, n.e.i. ... ... *ad. val.*	35 per cent.	50 per cent.	65 per cent.	75 per cent.
179. (C) Regulating, starting and controlling apparatus for all electrical purposes, including distributing boards and switchboards, n.e.i. *ad. val.*	35 per cent.	50 per cent.	65 per cent.	75 per cent.
179. (D) (1) Dynamo-electric machines:				
(a) *Alternating current motors, 1 h.p. to 125 h.p., both inclusive* each motor and *in addition per h.p.* or *ad val.* whichever rate returns the higher duty.	40 per cent. or 45 per cent.	55 per cent. or 60 per cent.	£5 15s. 45 per cent.	£5 15s. 60 per cent
(NOTE.—*Horse power shall be determined in such manner as is prescribed by Departmental By-law.*)				
(b) *N.e.i.* ... ... *ad val.*	40 or 45 per cent.	55 or 60 per cent.	45 per cent.	60 per cent
(D) Static transformers:				
(a) *Up to and including 25 kVA* ... ... *per kVA*	35 per cent.	50 per cent.	50s.	50s.
(b) *Exceeding 25 to 150 kVA inclusive* ... ... *per kVA*			25s.	25s.
(c) *Exceeding 150 to 500 kVA inclusive* ... ... *per kVA*			15s.	15s.
or *as to* (a), (b) *and* (c) *ad val.* whichever rate returns the higher duty.			60 per cent	75 per cent
(d) *N.e.i.*, including induction coils for all purposes unless otherwise expressly provided for ... ... *ad. val.*	35 per cent.	50 per cent.	60 per cent	75 per cent
(4) Electric current rectifiers ... ... *ad val.*	40 per cent. or 45 per cent.	55 per cent. or 60 per cent.	45 per cen.	60 per cent.
179. (F) *Ironclad or moulded switches; ironclad or moulded airbreak switches and fuses combined:				
(1) *Up to and including 60 amperes* ... ... *each* or *ad val.* whichever rate returns the higher duty.	3s. 45 per cent.	5s. 60 per cent.	8s. 65 per cent.	10s. 75 per cent
(2) *Over 60 amperes* ... ... *each* or *ad val.*	3s. 45 per cent.	5s. 60 per cent.	65 per cent	75 per cent.
180. (1) *Dry batteries and dry cells imported separately or incorporated in any article:*				
(New Sub-Item.)				
(1) *Up to and including 1 lb weight* ... ... each	27½ per cent. *ad val*	40 per cent. *ad val.*	4d.	6d.
(2) *Over 1 lb. weight* .. .. per lb.			7d.	10d.

* The "Former rates" are those imposed on November 22nd, 1928; they were again amended on December 12th.

A Unique Lifting Scheme.

The dance floor of the Savoy Hotel Restaurant can be raised to a height of 2 ft. 3 in. above the permanent floor.

A UNIQUE engineering feat has just been completed at the Savoy Hotel, London, where considerable structural alterations are being carried out. The problem was to raise the dance floor of the restaurant, which has an area of 40 ft. by 20 ft., to a height of 2 ft. 3 in. above the permanent floor, when required, for the purpose of giving a cabaret entertainment, with an uninterrupted view from any part of the restaurant, and lowering it afterwards at a moment's notice to the permanent floor level for dancing. The greatest difficulty the engineers had to contend with was that immediately under the restaurant is situated the main ballroom, the ceiling of which could not be interfered with. It was obvious, therefore, that any raising mechanism of the platform would have to be situated between the ceiling of the ballroom and the floor of the restaurant.

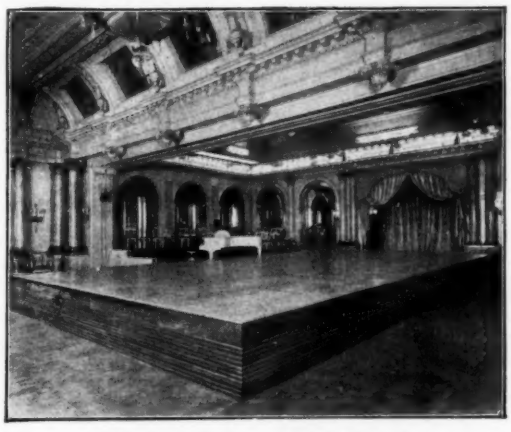


Fig. 1.—Dance Floor, Raised.

The scheme eventually decided upon by Mr. Pay, the chief engineer of the Savoy Hotel, and the Express Lift Co., Ltd., was a patented system of multiple hydraulic rams with electric push-button control. Eight hydraulic lifting rams and cylinders were therefore fitted in the floor of the restaurant for raising the platform. These were installed in such positions that they did not project through to the ceiling of the ballroom. The platform itself is of steel framework, specially constructed to give the minimum depth possible, and on this is carried the oak parquet dance floor. As much of the permanent floor under the rising floor as possible was removed to gain the utmost depth, the whole of the restaurant floor being then built up to the level of the rising dance floor when in its lowest position.

With a platform of this size to be raised and lowered by means of multiple rams, it is inevitable that unequal loading will take place; if equal hydraulic pressure were applied to each of the eight rams, the speed of each would vary according to the loading on the corresponding part of the platform, with the result that the platform would attempt to rise unequally. To overcome this, a specially constructed hydraulic machine, fig. 2, has been designed, by means of which all the hydraulic rams raising the dance floor must move up and down at equal speeds, irrespective of unequal loading on the floor. For example, a grand piano and orchestra could be arranged at one end of the rising floor, and the whole raised or lowered in a perfectly horizontal plane. This machine is situated three floors down from the restaurant, and hundreds of feet of high-pressure hydraulic pipes have been run to connect with the cylinders and rams operating the rising floor. The starting valves controlling the hydraulic machines are also situated in the basement, and are electrically operated by push-button switches fixed three floors above at the rising-floor level. The momentary operation of either of these "up" or "down" push-buttons will start in operation the electric and hydraulic control in the basement, the platform starting into motion and travelling to the end of its stroke, slowing up and stopping automatically. A further push-button switch is fitted, the operation of which stops the platform in any intermediate position. When the platform is in a raised position, fig. 1, the sides and space below to the permanent floor are protected by folding shutters, which fold away under the new permanent floor when the platform descends. Fig. 3 shows the driving motor and control board.

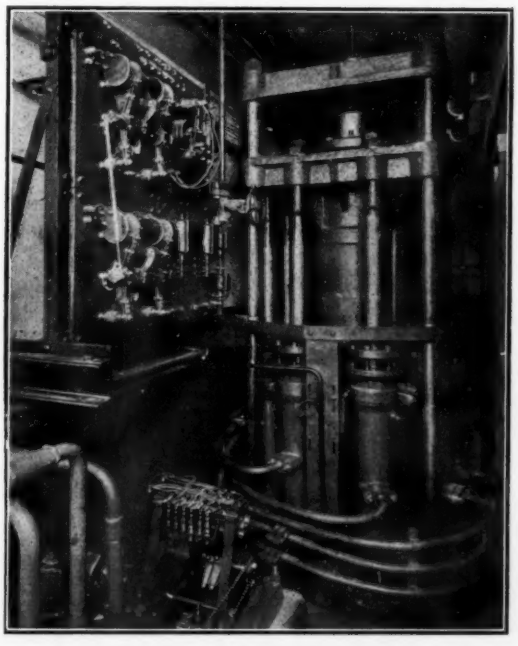


Fig. 2.—"Eight-ram" Hydraulic Lifting Machine.

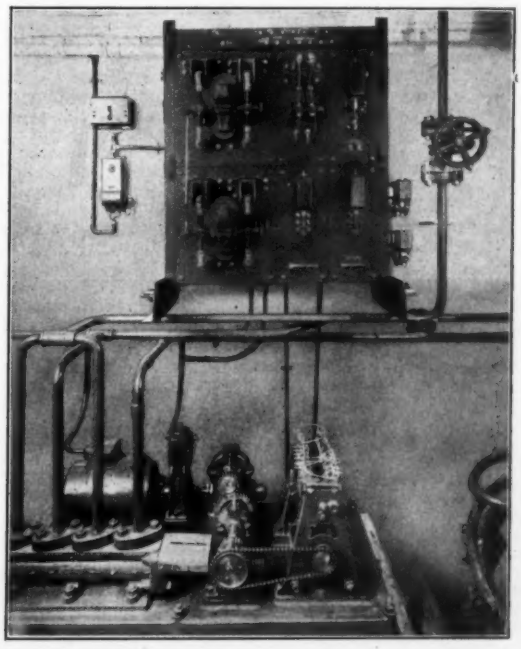


Fig. 3.—Driving Motor and Control Gear.

The whole of the work, of course, had to be carried out with the minimum inconvenience to the residents of the hotel. In this connection it is interesting to note that, although part of the restaurant was partitioned off for the fitting of the floor, the whole of the work of fitting the rising floor and its mechanism was completed in six days, when the platform was moving up and down, undergoing the most critical tests and operating in an entirely satisfactory manner.

Transmission-Line Protection.

Factors which influence the choice of protective systems and the requirements to fulfil modern exacting conditions.

By T. W. ROSS, A.M.I.E.E., and H. G. BELL, M.Sc.(Tech.). A.M.I.E.E.

(*Extracts from a paper read before the* INSTITUTION OF ELECTRICAL ENGINEERS.)

SOME of the difficulties which have arisen in practice are emphasised, and some of the methods of overcoming them are described. The design and lay-out of distribution systems, the earthing of the neutral point, and the application of arc-suppression coils are briefly discussed, more particularly in their relation to problems of protection.

Many factors in the design and lay-out of distribution systems and switchgear materially influence the effectiveness of the protective measures, and should be given due consideration when a system is planned. Such a course will, in many cases, result in more satisfactory protection with less complicated gear. The introduction of reactances, for instance, between different parts of a system is often helpful in limiting the short-circuit current which would otherwise be heavy enough to cause disturbance to the whole system, and their use is becoming more common, particularly at tie points, where the effect upon the voltage regulation of the system is less pronounced than if reactors were used in series with individual feeders.

The practice in this country is to earth the neutral point through current-limiting resistances on e.h.p. systems up to 33 kV, on the assumption that most faults start as faults to earth and that, by reducing the current which can flow to earth, less disturbance will arise. There is, however, a danger in applying this method to the higher-voltage systems, since the resistance, by maintaining the voltage on the faulty phase, will cause a rise in pressure between the healthy phases and earth, which may result in the development of an earth fault on one of these phases at any point on the system. It is also possible that transient voltages may be present which can add to the fundamental voltage, and thus increase the strain on the insulation of the sound phases. Again, at the higher voltages earth faults very quickly develop into short-circuits between phases, when the earthing resistance cannot limit the magnitude of the current. The short-circuit between phases may, in many case, be prevented by quick clearance of the earth fault, but this can often be more easily accomplished by allowing a greater current to flow, and so help in the operation of the relays. It would appear that it is preferable to have a solid earth connection for voltages above 20 kV.

From the protection engineer's point of view, earthing the neutrals of transformers at several points on the system has much to commend it, not only because it limits transient excess voltages, but also because it facilitates the application of some relay schemes.

The practice of operating with an insulated neutral, which is common on the Continent, has not proved entirely satisfactory, and with the object of obtaining an improvement in the operation of such systems, a number of arc-suppression, or Petersen, coils have been installed since 1920. The device consists of an iron-cored reactance having a number of tappings connected to a suitable tapping switch. The coil is connected between a neutral point and earth, and its inductance is adjusted by means of the tapping switch, so that at the fundamental frequency it resonates with the electrostatic capacity to earth of two phases of the network. When an earth fault takes place, therefore, current will not flow to earth through the fault, and an arc cannot be maintained. The result is that in the case of a flash-over on an insulator the probability is that the fault will clear itself without the necessity of tripping the circuit breakers. There will also be little danger of an abnormal rise in voltage between the healthy phases and earth, such as results from the repeated formation and extinction of an arc. Even when the fault is caused by a breakdown of an insulator, the arc is extinguished and the possibility of excessive strain on the insulation of healthy phases is less than would be the case if the system had an insulated neutral and no arc-suppression coil. This method has, perhaps, greater possibilities when applied to overhead lines than to cable networks, because earth faults on the former are usually caused by the flash-over of an insulator, in which case the suppressor would prevent the arc doing damage, and the fault would probably clear itself.

A development of this method of earthing permits the use of selective relays for the isolation of faulty sections, whilst retaining the advantages resulting from the use of the arc suppressor. A relay having a suitable time delay is energised from the suppression coil and operates to connect the system to earth, either directly or through a resistance, should an earth persist on any line. The system then becomes temporarily an earthed system, and the faulty section can be isolated by suitable protective gear. The arc-suppression coil is so adjusted that resonance is obtained between the inductance of the coil and the electrostatic capacity of the healthy phases. Theoretically this arrangement is very attractive, and it is at present being operated by several companies abroad.

An attempt is made to indicate the lines along which modern protective methods are developing, and to set out the relative merits of each in a very general sense. The capital cost and maintenance charges of protective gear are generally regarded as a type of insurance premium, and the amount of money allocated for this purpose will largely be determined by the value placed upon the continuity of the supply at all points.

The several methods of obtaining discriminative protection are reviewed: commencing with modern designs of time-discriminative over-current relays, emphasis is laid upon the importance of a definite minimum time characteristic and upon correct methods of obtaining directional features. The special requirements of such relays when applied to give sensitive earth-fault protection are indicated, and means of obtaining a suitable polarising voltage are explained; a description of sensitive earth-fault relays of the wattmeter is also included.

The theory and application of impedance relays is discussed, with reference to definite-impedance and impedance-time relays. A method of compensation for voltage-drop across the arc resistance of a fault is indicated. The field of application of low-voltage release relays is defined, and the method of their use is illustrated.

Attention is directed to the advantages of pilot-wire feeder protection, and the limiting features of older forms are mention. Typical modern opposed-voltage and circulating-current methods, which are giving satisfactory service on modern systems, are described in some detail. The new field of direct-current pilot-wire protection is discussed; the main classifications of this type of gear are defined and examples are given, as an alternative to balanced systems. These systems have the advantages that the balancing of the protective apparatus at the two ends of a feeder is not necessary, and, if suitable relays are used, it is also possible in some cases to use an earth return and so save a pilot conductor; alternatively, the fact that pilots carry only direct current permits the use of standard pairs in telephone cables without any possibility of interference taking place.

A development of the scheme is to use rectifiers to provide the direct current for operating the pilot relays. This has the advantage that batteries of equal voltage are no longer necessary, because the direct current for the pilot circuit is supplied from the protective transformers through the rectifiers. A small summation transformer, so arranged that there will always be a secondary voltage derived from the fault current on any phase, is used to obtain the a.c. voltage for the rectifier. The transformer is designed to saturate at about four times the minimum fault setting, which assures that the d.c. voltages at each end of the feeder will always be approximately equal, even when the protective current transformers have dissimilar characteristics.

The rectifier must be of a type which starts to rectify immediately the a.c. supply is applied to it; the copper-oxide type has proved to be very reliable. The saturated summation transformer prevents an over-voltage being applied which might break down the rectifying copper-oxide film, and, moreover, as the rectifiers are connected to the supply only during fault conditions, they will be practically everlasting.

Little operating experience has yet been obtained with

interlocking schemes such as these, but several experimental installations have been made. It is possible that in the future there will be a wide field of application, especially on long lines or feeders, for schemes of this general type, and further developments are to be anticipated.

The paper concludes with a novel and flexible method of protecting duplicate and multiple parallel feeders. Whenever two or more similar feeders are connected to a common busbar at each end, it is possible to employ an instantaneous unit protective equipment of the balanced type without pilot wires. This form of protection has many advantages and well deserves the consideration of supply authorities.

An equipment comprises differential relays connected to current transformers associated with corresponding phases of two feeders, the principle being the simple comparison of the currents in the feeders. The relay remains inoperative until the balance of currents is disturbed by a fault on either feeder, when the difference is effective to energise the relay to cut off the faulty feeder.

In the case of two dead-ended parallel feeders, the fault current passing to a fault in the immediate neighbourhood of the "receiving" sub-station may have two paths of nearly equal impedance, so that the difference in the feeder currents is insufficient to cause relay operation at the outgoing end. At the receiving end, however, the fault power flows in opposite directions in the two feeders and, by using relays with a sensitive directional element at that end, advantage can be taken of this condition to trip the circuit breaker at the receiving end immediately a fault occurs, thus leaving only a single path through the faulty feeder for the fault current. The difference is then a maximum at the outgoing end, and operation of the relay follows immediately on the clearing of the receiving end. If directional relays are arranged for overload and sensitive earth leakage, the potential coil of the leakage relay must be energised according to one of the methods already described for directional leakage relays.

What may be classed as a limitation of this form of protection is that its satisfactory operation involves vigilance on the part of station operators to ensure that the circuit breakers at both ends are opened whenever a feeder is taken out of commission. The reason for this is that auxiliary switches on the oil circuit-breakers are generally used to disconnect the differential relays when the balance is disturbed owing to one of the associated feeders being unloaded, and to leave a circuit breaker closed at one end may result in wrong operation of the relays with consequent tripping of the healthy feeder at times of fault on other sections of the system.

In the event of settings equivalent to full load or less being necessary they can be obtained, for earth faults only, by connecting one pole of the balanced relay to be operated by the residual currents of the current transformers in the feeders; any convenient settings for earth faults can then be chosen. With such an arrangement it is possible to carry out switching operations without danger of incorrectly tripping loaded feeders under normal load conditions, since, although the phase-fault relays tend to operate before the incoming feeder picks up its load, the high setting would prevent the contacts from closing; whilst the earth-fault relay with a lower setting will remain stable because no current will flow through either of its coils under healthy conditions.

In applying such protective gear to parallel feeders it has been the custom to group feeders in sets of two or three. A recent development has made it possible to employ larger groups, with considerable gain in flexibility.

The differential elements of the relays are similar in type to the "Translay" relays, but the secondary voltages of all the relays associated with similar phases of the various feeders are connected to a common wire, and the two coils of the operating magnet are connected in opposition. So long as equal primary currents flow in the various feeders, equal voltages will be generated in all the secondary windings and the relays will remain stable. During through faults the stability of the relays will be assisted by the biasing arrangement just as in the case of "Translay" pilot-wire feeder relays. Owing to the arrangement of the operating magnet coils, no relay can operate under any conditions unless power flows into the feeder, thus causing the contacts of the directional element to short-circuit one of the two opposing coils.

In the case of a fault on one feeder when the group is carrying load away from the busbars, the secondary voltage of the corresponding relay will be increased and the resultant secondary current will cause that relay to trip. The same current returns through the secondary windings of relays on other feeders and will give a stabilising torque to those relays. In the event of a fault on one feeder when all are carrying load towards the busbars, the reversal of the secondary voltage of one relay would tend to operate all relays, but since the lower operating coils of all relays of healthy feeders can produce no flux (the two coils of each relay being in opposition) only the relay of the faulty feeder, in which one of the coils is short-circuited by the directional element contacts, can operate, so that the faulty feeder will be correctly isolated.

In conclusion, the authors emphasise that it is possible, by a correct choice from the various systems described in the paper and others of generally similar types, to obtain stable and discriminative protection of feeders, even under the most difficult conditions obtaining to-day, so that the art of protection may truly be said to have overtaken the present demands made upon it. In future new requirements, some already envisaged, will no doubt arise, but protective problems will not constitute a limiting factor in the development of transmission systems.

The authors acknowledge their indebtedness to the Metropolitan-Vickers Electrical Co., Ltd., and to the British Thomson-Houston Co., Ltd.

Discussion in London.

So far as protective systems were concerned this country was considered to be paramount. Protective gear design was a "disease," part of which was that one's own type of relay was the only one that was any good. In this country a fault duration of longer than one second, or a possible maximum of two seconds, would not be countenanced, whereas on the Continent a fault was often allowed to remain for ten seconds, under which condition it was easy to provide discrimination.

The authors had rightly stressed the importance of the impedance relay, in contrast with the reactive type, and much would be done with the former in future. The inverse time characteristic sometimes afforded a little more discrimination and was simple, but it was sometimes made too much of. The paper described three methods of attacking an identical problem; 16 relays, all fulfilling different functions, were described; the methods outlined involved great precautions being taken and balancing of a laboratory character, so that the station engineer who had to make a choice of system was bewildered. Difficulties should not be overcome in secondary ways by the addition of "gadgets." The problems could be solved, however; for instance, on one system in Australia, over 60 faults had occurred on the h.v. cables, and in each case the protective gear had functioned as it should do.

The paper did not mention phase filters, which were intended to let though just those fault effects that were most desirable for relay operation. Neither did it mention the combined protection of feeders and transformers connected solid as units, in order to eliminate switchgear, which was becoming very expensive.

Arc resistance had been somewhat exaggerated; on long h.v. lines any compensating device would tend to over compensate, and would therefore be better omitted. The development of long-distance, high-voltage, overhead-line transmission precluded the use of ordinary methods and pilots, though one speaker maintained that for long lines, the continuity of which in service was essential, pilots would still have to be resorted to. Mr. Bernard Price's responsibility for the basic idea was not always given the prominence it deserved; the Merz-Price system was now 25 years old. It was desirable to complete the I.E.E. records of protective methods by the inclusion of descriptions of systems which had not been dealt with in the paper.

Electron Diffraction by Mica.

In a paper in the *Zeitschrift für Physik* for December 9th, on the diffraction of electron waves by mica, Dr. E. Rupp discusses some of the earlier results obtained by Kikuchi in this connection (see *Nature*, February 9th, 1929, p. 224). With thick sheets of mica, Kikuchi had obtained the diffraction patterns of a three-dimensional array of atoms, and with thin sheets the patterns of a two-dimensional lattice; some of the thin sheets which he used were, however, of the order of a hundred atoms thick, and it is not obvious why these should not have produced the same results as thicker sheets. Dr. Rupp attributes the effect to a generation of heat in the mica when it is bombarded by electrons. He supposes that the planes of atoms which produce surface effects are relatively little affected as individuals by an increase in thermal motion, but that they undergo sufficiently large shifts with regard to one another to destroy regular volume interference. Dr. Rupp supports this explanation by experiments in which he has been able to produce either type of pattern with a single specimen of mica simply by varying the electron current to it. With the very considerable disengagement of heat that occurs when electron currents of about 0.1 ampere are supplied at a power of 3 kilowatts, it is possible to obtain the patterns from the plane gratings even with a sheet of mica 10^{-4} cm. in thickness.

Examination of Incombustible Matter in Coal by X Rays.

In a recent lecture before the Society of Arts, Mr. C. N. Kempe described a method of applying X-rays to the examination of coal and coke for incombustible impurities. Coal is opaque and relatively inert to reagents and solvents, so that quick analytical separatives are not feasible. The methods ordinarily in use give no indication of the distribution of ash in coal, but information on this point is necessary for any decision as to the practicability of coal cleaning.

New Electrical Devices, Fittings, and Plant.

Readers are invited to submit particulars of new or improved devices and apparatus for publication in this section.

An Electric Hand Drier.

The "ECO" double-jet hot-air hand dryer, fig. 1, which is being marketed by THE EQUIPMENT & ENGINEERING CO., LTD., 2 & 3, Norfolk Street, Strand, W.C.2, has been designed to eliminate the use of hand towels in public lavatories, and, as its name implies, it has two powerful jets which emit a very strong current of hot air, enabling the hands to be dried

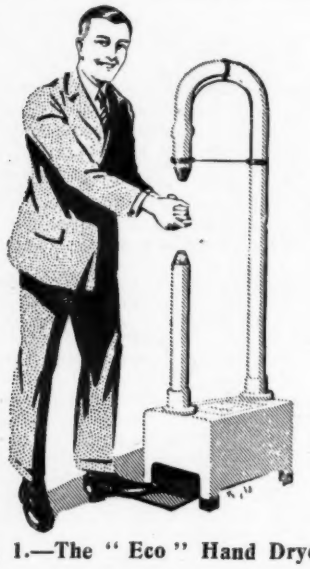


Fig. 1.—The "Eco" Hand Dryer.

in 25 seconds. The time for drying is so short that there is no risk whatever of getting chapped or cracked hands, and the hot air acts as an antiseptic. This hand dryer is always ready for use, it being only necessary to step on the pedal. The loading is 1,500 watts, and each unit is supplied with a universal motor and a 10-A plug with an earth contact.

A Fibre-washer Outfit.

A useful workshop accessory recently marketed by the MARTINDALE ELECTRIC CO., LTD., The Hyde, Hendon, N.W.9, is a case containing an assortment of fibre washers, fig. 2. The case is divided into 24 sections by wood partitions, and it is provided with a sliding lid. There are 480 washers,

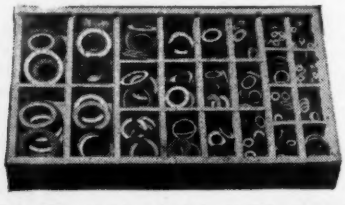


Fig. 2.—The "Martindale" Washer Outfit.

supplied in lots of ten for 48 sizes. The washers are 1/16 in. and 1/32 in. thick, and vary in size from 3/16 in. by 3/32 in. to 1¼ in. by 15/16 in. The washers are supplied in four colours, white, black, red and grey.

A New Type of Counter E.M.F. Starter.

An interesting addition has lately been made to the standard range of counter e.m.f. starters manufactured by the GENERAL ELECTRIC CO., LTD., Magnet House, Kingsway, W.C.2, a new type 2 starter, fig. 3, having been developed to deal with larger motors. In this type of starter the counter e.m.f. of the motor itself is utilised to regulate the closing of contactors during starting. The starter is specially suitable for all d.c. services, where the machine starts up light, *e.g.*, for machine tools, wood-working tools, small printing machines, small compressors, pumps, and so on. Two patterns are now manufactured by the G.E.C., a light-duty pattern (type 1) and a heavy-duty pattern (type 2) for the higher horse powers (up to 5 h.p.). The starter consists essentially of a line contactor and an accelerator contactor mounted with a resistance in a ventilated box, the whole forming an exceedingly compact and workmanlike job. In the new type 2 starter, the line contactor is fitted with a magnetic blow-out and is electrically interlocked with the accelerator contactor. Since the

Fig. 3.—"Magnet" Counter E.M.F. Starter.

coils of the line contactor are shunt-operated, the starter also functions as a no-volt release. The starter is automatic in operation, and it can be controlled from one or more operating points with the utmost simplicity.

A Flexible Cable Former.

The accompanying illustration, fig. 4, is of the "Symplist" wire or cable former, a product of Messrs. GEORGE HUMPHRY, 25B, High Street, Wimbledon, S.W.19, designed for use with electric table standards, or wherever there is a flexible cable or other connecting lead to the device or apparatus. The former is made of strong fibre or plyboard in several sizes. A novelty of the appliance is the arrangement by which one is able to apply the former to any fixed lead by means of the "gate" entry

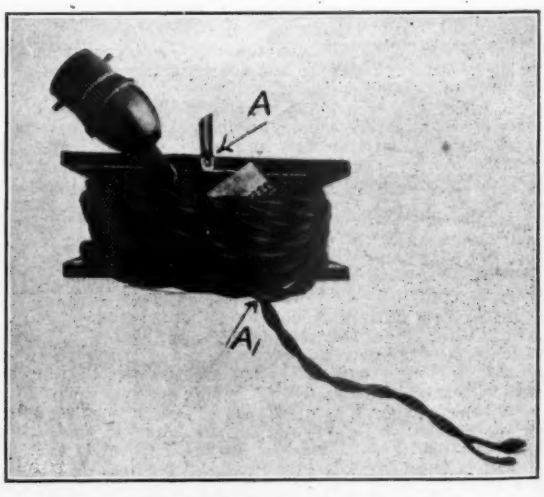


Fig. 4.—The "Symplist" Cable Former.

to the hole; this is kept latched by metal clasps at A and A1. Obviously the apparatus keeps the cables in a better state of order and condition than the method of winding it in a "kinked" coil about or around the apparatus. The size of former illustrated is approximately 1¾ in. by 4 in., and it has a capacity of 4 yards of 14/36 twin flexible, a size generally used on small articles.

Oil-filled Electric Cables.

Details of construction and methods of laying 132,000-volt "Pirelli" power-transmission cables underground in London and elsewhere.

(Extracts of a paper read before the ASSOCIATION OF MINING ELECTRICAL ENGINEERS.)

AT a recent meeting of the London Branch of the Association of Mining Electrical Engineers, Mr. R. E. Horley, of the Pirelli-General Cable Works, Ltd., read a paper on the above subject in the course of which he explained that in America three-phase underground cable lines had been laid to carry approximately 100,000 kW, at a pressure of 132,000 volts, resulting in very large savings in comparison with cables working at 33,000 volts. At the present time, 132,000-volt cables were being laid in London between Kidbrooke and Deptford and between Wimbledon and Battersea, capable of transmitting 80,000 kVA. To-day underground cables could be manufactured for pressures as high as 220,000 volts.

When a normal three-core cable insulated with dried paper and impregnated with a very viscous compound was in service, the comparatively large volume of compound held in the insulation expanded as a result of the increased temperature and must find additional space for its accommodation, principally at the expense of the lead sheath, which became distended. When the cable cooled during periods of lighter loading, the compound contracted, but the lead sheath did not contract with it, mainly owing to its inelasticity. Spaces were thus left between the lead sheath and the cores, and in time the compound drained out of the insulation into those spaces, resulting in the formation of voids within the cable insulation. If dielectric power-factor tests were taken after the cable had been in operation for some time, the power factor would be found to have increased, indicating a change in the degree of impregnation of the insulation. It had been found by experiment that electric breakdown, or discharge across voids or spaces in the cable, resulted in the production of a waxy substance, the generation of gases, including hydrogen, and the formation of water by chemical combination. Whilst the waxy substance had excellent insulating properties, the formation of water was, no doubt, one of the chief causes of cable deterioration. Again, the low mechanical pressure to which the dielectric was submitted, especially when the load was off, resulted in low dielectric strength, and consequently possible breakdown. In addition, the gaseous films, especially when the mechanical pressure was low, were highly ionised, and built up conductive laminæ which produced distortion in the electrostatic field along the surfaces of the paper tapes. At high stresses it had also been found that gases migrated through the paper sheets, under the action of the ionic bombardment, and built up an ionised path in the direction of the stress. Thus it was evident that ionised gas was highly undesirable in high-voltage cables.

A great improvement in the behaviour of some cables had been obtained in America by filling the joints with a very fluid mineral oil, which could be supplied by reservoirs connected to the joints. The oil was sucked into the cable by the vacuum produced by the cooling and contraction of the cable, the impregnation of the cable being consequently much improved; however, it was necessary: (1) to have a properly pre-determined channel in the cable for the movement of the compound; (2) to use a compound of suitable viscosity; (3) to reinforce the lead sheath to prevent it becoming distended, and (4) to use feeding devices of suitable capacity arranged at pre-determined intervals.

Those details had been studied with great care in the design of the oil-filled cable system. Single cables were used, so that the stresses were radial; the impregnating medium was a mineral oil of low viscosity, and the system was so designed that when the oil expanded due to the increase in the cable temperature the extra volume, instead of distending the lead sheath, was accommodated by means of external reservoirs ,which returned the oil to the cable when it contracted during periods of lighter loading. The cable was thus maintained full of oil under all working conditions. The oil was fed into the cable through a central channel formed by stranding the conductors round a plain narrow metal strip, so that a cavity was formed at the centre of the core, which was kept completely filled with oil by means of feeding tanks at a pressure which maintained just above atmospheric pressure at all points of the cable.

The oil used for impregnating the cable was clarified by passing it through a centrifugal machine and degasifying it. The latter operation was a most important one, having regard to the effect of gaseous films in a cable dielectric. Owing to the preparatory treatment of the impregnating oil and the improved method of impregnating the cable, the stress per mm. of insulation that could be used with safety was about 50 per cent. higher than the maximum stress that could be safely employed in cable of ordinary construction. The thickness of dielectric of oil-filled cables was thus considerably less than that of normal-type cable for an equivalent voltage.

The special feeding tanks were, in effect, reserviors connected to the cable and placed at a height above it in order to obtain the necessary hydrostatic pressure determined by calculations from the profile of the line. It was essential that the oil in the reservoirs should not be in contact with the surrounding air in order to maintain it in its degasified condition; further, it must be kept at practically atmospheric pressure, independent of the quantity of oil in the reservoirs. Those conditions had been fulfilled by constructing the reservoirs in the form of flexible-walled cells made of corrugated nickel plates, the number and size of the cells depending upon the amount of oil required for the operating conditions in the cable at the particular point. Each cell was composed of a channel ring, at each side of which was soldered a corrugated nickel diaphragm with a retaining ring. The corrugation allowed the plates to move under expansion and contraction. Two sizes of feeding cells or elements had been standardised, a certain number being paralleled together to form a tank. A number of tanks might be paralleled together by means of valves and manifolds to hold the necessary volume of oil.

The pressure at any point within the cable must not be allowed to drop below atmospheric pressure, and therefore the length of cable that might be fed from one source was limited. The length of section, however, could be considerably increased by installing a pressure tank, its function being to assist the feeding tank in providing accommodation for expanding oil and returning oil to the cable upon cooling. It differed in principle from the feeding tank in that it did not depend upon gravity for its action, and therefore need not be placed at a height above the cable. The size of the pressure tank depended upon the two following considerations: (1) when the cable was cooling down, how much air must be imprisoned in the cells of the tank so that its increase in volume between its normal static pressure and the minimum pressure required to send oil to the farthest point fed from the feeding tank would be equal to the volume of oil required by the length of line the pressure tank was feeding; (2) when the cable was heating up, how much air was required in the cells so that, starting at static pressure, the tank could accommodate the excess oil due to expansion of the oil in the cable without being compressed to a higher pressure than the safe maximum working pressure of the tank? Whichever of those two calculations gave the higher result decided the size of the tank used.

The author stated that the oil-filled cable system swept away the complex difficulties of the normal type of high-voltage cable, and the problem, instead of being an electrical one, became simply one of hydrostatics capable of solution by calculation and respecting well-known laws.

In spite of the expense involved in the provision of the oil-feeding accessories, the total cost of an oil-filled cable system was less than that of a normal cable capable of transmitting the same amount of power,* owing to the fact that it was possible to transmit much greater loads with safety.

Discussion in London.

Mr. S. AUSTIN STIGANT noted from a photograph shown by Mr. Horley of six joints on 66-kV oil-filled cables in London, each joint being in a separate concrete container, that three bolts were fitted to each container to hold the cable rigidly on each side of the joint, in order to relieve the joint of the stresses set up by expansion. What provision was made for taking care of the expansion set up in the cable itself as the result of variations of load? Further, he had not yet seen any references to the application of the oil-filled system to multi-core cables; were there any inherent difficulties in applying it to such cables? Sludging was a possibility of all mineral oils, but the internal temperature of an oil-filled cable was probably considerably lower than that of transformers.

Mr. F. HEPPENSTALL suggested that, in referring to the oil-filled cable as something of a novelty, Mr. Horley had not gone far enough; it was really an epoch-making innovation, as important in electrical science as was the invention of the turbine by Sir Charles Parsons. Scientific progress was so rapid that there was a tendency to overlook such facts,

* ELEC. REV., May 24th, 1929, p. 905.

but when one considered that it was possible by means of oil-filled cables to transmit large blocks of power at 220,000 volts with perfect safety, one must admit that the invention was one of the very first importance. It had been mentioned that the oil-filled cables in America would carry 100,000 kW at 132,000 volts, but it was as well to add that they were the largest cables in the world at the time they were put into operation, and that the power company which had installed them was liable to a penalty of 400 dollars (£80) for every minute during any cessation of service, and that there was no spare cable. Those facts were sufficient testimony to the reliability of 132,000-volt oil-filled cables; they were extremely robust. All cable engineers in Engand had been extremely careful in handling high-voltage cables in cold weather, particularly if they happened to be 33,000-volt cables; they did not bend them at too sharp an angle, and they did not bend them twice if they could avoid doing so; but in America 132,000-volt cable had been laid by means of a Ford tractor, which travelled along the street surface pulling a rope through a manhole, the cable being attached to the end of the rope; the driver of the tractor was clad in furs, and there were snow and ice on the ground. It had been a great surprise to him to learn of the handling of a 132,000-volt cable during weather in which engineers in this country would not think of handling 11,000-volt cables. Another thing which had impressed him was the extreme care with which the details of the system had been thought out. The up-to-date cables and accessories Mr. Horley had exhibited were the result of the exercise of meticulous care by experts in such matters as the expansion of oil with increase of temperature, the friction of oil in the ducts in which the expansion took place, and the provision of sufficient facilities for the accommodation of the increasing quantity of oil expelled from the cables as their temperature rose. He believed there was no reason why oil-filled cables should not operate at any temperature up to 80, or possibly 100, deg. C. He had seen the system in operation, and congratulated the patentees upon having catered for every known point connected with the technique of cable making.

Mr. A. F. W. RICHARDS asked a number of questions. He did not think anybody in the world was operating three-core cables at high pressure at a temperature higher than, say, 60 deg. C. The paper contained much valuable information which, he believed, had not been published before in this country.

Mr. J. R. COWIE (branch hon. secretary) said that the pressures at the terminal ends of transmission lines could be surprisingly high; the pressures on terminal end boxes varied from 80 to as much as 400 lb. per sq. in. It seemed to him that there was some limiting head to which Mr. Horley was working, and it was just possible that towards the terminal ends he was putting in diaphragm sealing joints. That point was becoming of increasing importance in various sections of industry. He believed it was no secret that high-voltage cables, even at 220,000 volts, were being taken right into the middle of big cities, and the problem of the ways and means of handling and distributing the power there had been solved; but one of the main problems was what would be the pressure on the end joints, or end boxes, or sealing bells, at the points at which the cables were joined with other apparatus. A certain amount of research was being conducted, and it had been found that an oil which possessed a reasonably high dielectric value when tested by well-known methods, might yet contain a dangerous percentage of moisture. Were special precautions taken to ensure that the oil used was reasonably free from moisture?

Mr. R. E. HORLEY, replying, said that in the London installation of oil-filled cables, the cables were laid in the familiar triangular formation, but they did not remain in the same relative positions throughout the whole of the lengths between joints. Over part of the route the top cable was laid over against the bottom cable, and was then brought back to its original relative position before the next joint was reached. Each cable was treated in that way, so that there was a definite amount of slack between any two joints, allowing scope for expansion. At the same time, he did not consider that that precaution was really necessary. There was no reason at all why multi-cored cables of the oil-filled type should not be made; in fact, a 60,000-volt, oil-filled, three-core cable was working in Milan, Italy; it was an ordinary belted type, but the oil channels were formed in the lead sheath itself, between the belt and the lead. The joints were of the ordinary straight-through type. It was working quite satisfactorily, and no trouble had been experienced. So far the attention of his company had been concentrated upon 66,000- and 132,000-volt cables, and if cables of those types were made with three cores, their diameters would be greater than those of single-core cables, and the lengths of cable which could be handled would be shorter so that the number of joints would be increased. As the voltages at which oil filling was used decreased, he had no doubt they would adopt oil-filled three-core cables. In America three-core cables of the oil-filled type were used even down to 11,000 volts.

The extent to which oil filling increased the carrying capacity of cables obviously varied with the size of conductors, but he mentioned, as a guide, that in the normal type cable, the temperature rise accepted was usually about 30 deg. C., starting at 15 and rising to a maximum of 45 deg., some makers claiming that they could deal with a temperature of 50 deg. C.; but an oil-filled cable could deal with a temperature rise up to about 60 deg., so that there was a wide margin. The specification for the London installation had demanded heat cycles up to 100 deg. C. on cable laid in the ground. His company had carried out such cycles without trouble, and had demonstrated that the cable was just as good afterwards as it was before. It was then requested to carry the heat cycles as far as it could, but with the apparatus at its disposal it could only go to 135 deg. C., and after that it was demonstrated that the cable was just as good as before. It might be asked why the oil containers were not maintained at a temperature of 100 deg. C. The answer was that, if such large temperature ranges as that were used, obviously the pressures to be dealt with would increase, and that would mean either the provision of very much more apparatus, or else the strengthening of the cable to a very large extent. Further, a certain amount of trouble would probably be occasioned at the joints; average jointers could not wipe a joint really properly, but the defect was not noticed, because in the normal type of cable the compound was so viscous that trouble did not arise. When an average jointer wiped an oil-filled cable joint, one began to appreciate that he was not so skilled as one had imagined him to be. Therefore, it was found advisable to give jointers a short course of training in the jointing of oil-filled cables.

There was no danger of the oil sludging, because that was caused by oxygen in the air, but all the air was carefully removed from the oil-filled type of cables before they were laid and hermetically sealed. Further, they used a high-grade transformer type of oil, the best that could be bought; it was just a little more viscous than ordinary transformer oil.

With regard to dielectric stresses, if they had erred at all, they had erred too much in the direction of safety. His company was using only half the amount of insulation used on the normal-type cables; for a 66,000-volt cable it used only 8½ mm. of insulation, and such a cable had a pressure to earth of about 38,000. Life tests at 160,000 volts for 500 hours had been carried out, and the cable had been totally unaffected thereby, so that the factor of safety was enormous. Life tests had been carried out on 132,000-volt cable at 350,000 volts, and there had been long-period tests also up to 400,000 volts, so that there, again, the margin of safety was very great. They were of opinion that the normal-type 132,000-volt cable could be run at 220,000 volts, and their 66,000-volt cable could be run at 132,000 volts. They were also making a 33,000-volt oil-filled cable for which they were using 5 mm. of insulation, which contrasted with the 8½ mm. of the normal type of cable. The pressure to earth in that case was 19,000 V. After life tests had been carried out at 90,000 volts, the cable was unaffected.

The type of oil used had a freezing point of minus 30 deg. C., so that difficulties would not arise when laying cables in winter. Because the oil was so fluid they could be bent to sharper angles than could the normal type of cable; they were full of oil when wound on the drums finally and when being laid, and there was no fear as to the effects of bending. There was no heating of the containers, because the cold had very little effect on the oil. The viscosity of the oil increased as temperature dropped, but in calculating the size of tanks and the pressure, they examined the oil at all temperatures at which the cables were likely to operate and at temperatures beyond the operating temperatures, and took into account the viscosity, because there was a moment during the cycle in which the pressures rose to a maximum, not at full load, but when switching on at about one-third full load.

There was no difficulty in maintaining the terminals fully impregnated. If a terminal were anywhere near a large change in the profile of the line, so that there was likely to be a big pressure, they could put in a stop joint and a small pressure tank to take the pressure on the terminal. In America, where very bad storms were experienced, experiments were carried out in which two or three lengths of oil-filled cable were connected to an experimental overhead line. They were shocked with voltages of 500,000 several times, and the cable was then dissected in order to ascertain if it had suffered, but it had not, and it was concluded that the factor of safety was enormous.

The "drying" of oil, of course, was done in steam-heated containers under vacuum in the ordinary way, and the oil was tested in the normal way between a standard gap. A breakdown figure of 50,000 had to be obtained before the oil was accepted, and that was a fairly high figure.

Mr. J. R. Walton (branch vice-president) occupied the chair.

The Cost of Smoke and Soot.

The Mellon Institute a few years ago placed the tangible damage done by smoke in Pittsburgh at $20 for each resident, and for the United States as a whole at $16 *per capita*. Another estimate places the annual cost of smoke and soot for a few large cities as follows: Cleveland, $6,000,000; Cincinnati, $8,000,000; Pittsburgh, $10,000,000; Chicago, $17,000,000; New York, $96,000,000. The city dwellers of New York State, including those in New York City, pay $178,000,000 every year as a penalty for the smoke and soot nuisance.—*Power*.

The Physical Society's Exhibition—I.

Annual Display of Electrical Instruments and Scientific Apparatus.

THE twentieth annual display of electrical, optical, and other physical apparatus organised jointly by the Physical and Optical Societies, was held as usual on January 7th to 9th at the Imperial College of Science and Technology, South Kensington. As in previous years it included a trade section (83 manufacturers) and research and experimental portions, illustrating, respectively, the results of recent physical research (22 exhibitors), lecture and instructional experiments in physics (14 exhibitors), and historical apparatus (4 exhibitors); also Capt. H. Shaw delivered a short lecture at the Science Museum on the historical scientific apparatus of the Royal Institution, which can be seen at that museum.

In addition a new section was introduced this year for specimens of the unaided work of apprentices and learners in the regular employment of trade exhibitors, with the object of encouraging craftsmanship in the scientific instrument trade. The entries were classified in two sections (craftsmanship and design) according to age (under and over 18, but under 21) and eight money prizes were offered to the competitors, the judges being Dr. C. V. Drysdale, Prof. A. F. C. Pollard, Sir Thomas Stanton, and Mr. William Taylor.

Discourses were delivered on "Iridescent Colours in Nature from the Standpoint of Physical Optics," by Lord Rayleigh, M.A., D.Sc., F.R.S.; on "Gyro-compasses for Gun-fire Control," by Mr. S. G. Brown, F.R.S., M.I.E.E., F.Inst.P.; and on "Television, Present and Future," by Sir Ambrose Fleming, M.A., D.Sc., F.R.S., hon. M.I.E.E., the lectures being illustrated with experiments and demonstrations.

A review of some of the newer instruments included in the trade section of the show is commenced below :—

E.R.A. Circuit-breaker.

One of the most interesting items in the Research and Experimental Section was the British Electrical and Allied Industries Research Association's experimental gas-blast circuit breaker, which model represents an important advance in the art of arc rupture. The size of the gear is small, in comparison with modern switches of conventional design and similar capacity, it being designed to break 25,000 amperes at 11,000 volts. It is estimated that three such units as that shown, operating in a three-phase circuit, would be capable of rupturing three-quarters of a million kilo-voltamperes. The arc is extinguished by means of a blast of air, or other gas, instead of being ruptured by drawing it out to a considerable length in oil in the manner of the usual type of circuit breaker. An important feature is that the arc length is not allowed to exceed about 2 cm., and the blast is so guided to the vent passage by a specially designed mouth that the arc cannot escape by blowing in any direction between the electrodes; it is always extinguished within one cycle of the commencement of arcing.

H. W. Sullivan, Ltd.

A feature of this company's stand was the remarkable display of precision wavemeters of every type, the models shown totalling over £1,500 in cost and ranging from a mutli-vibrator standard to those of the heterodyne type. The ultimate standard of wavelength is still the valve-maintained tuning fork of Dr. D. W. Dye, and the latest model of this precise generator was demonstrated, controlling the frequency of a multi-vibrator from which harmonics of all frequencies from 10 to 1,200 kc were obtained, all harmonically synchronous with the fork. The Dye multi-vibrator and its fork made by this company are now in use as national frequency standards for radio throughout the world, and are being constructed for many standardising institutions and large manufacturing companies. In order to obtain great accuracy of frequency determination it is advised that frequent checking of the fork frequency against a standard clock be effected by means of long-period runs of a phonic wheel synchronously driven by the fork, which procedure, together with temperature control of the fork, is now advocated when the equipment is intended for use as a national standard.

An elaborate precision sub-standard wavemeter has been designed by Mr. W. H. F. Griffiths to give the highest accuracy that it is possible to attain in a simple wavemeter (of considerable range) in which the calibration depends upon values of capacity and inductance. The model exhibited (fig. 1) had a range of 100 to 10,000 metres and an accuracy of 1 part in 10,000, while the temperature coefficient was less than 4 parts in 10^6 per deg. F. from 100 to 3,000 metres, and of the order 1 part in 10^6 per deg. F. for the higher wavelengths. The remarkable calibration accuracy, permanence, and low temperature coefficient of this sub-standard are due to the use of specially designed Sullivan-Griffths series and complementary dielectric-gap variable condensers and temperature-compensated inductances. Either the thermo-current or the more sensitive crystal-rectified current method of resonance detection may be employed, or the wavemeter, it was demonstrated, can be used as a simple thermionic generator of great utility as well as accuracy. This is accomplished by using a screened-grid four-electrode valve merely as a negative resistance device to produce continuous oscillations in the resonant circuit, without the use of a complicating coupling coil for reaction; the accuracy of the wavemeter is unaffected by generation in this way, because the inter-electrode capacity of the valve has been specially reduced to such a value as to ensure the permanence of the whole circuit and the variation of the generated frequency with variation of filament current and of the potentials of the various electrodes is negligibly small.

A short-wave precision sub-standard wavemeter was shown (fig. 2) of 5 to 100 metres range; calibration permanence is

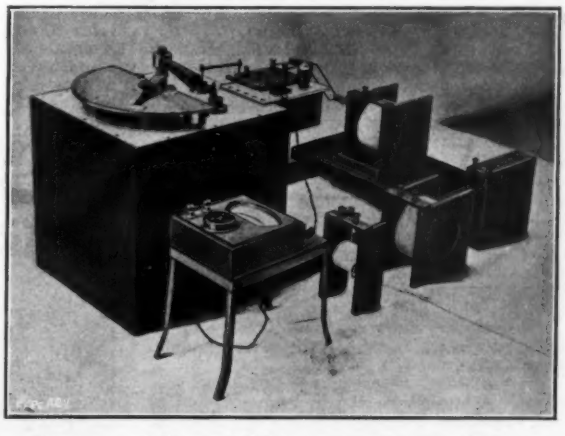


Fig. 1.—Sullivan-Griffiths Wavemeter, 100 to 10,000 m.

ensured largely by employing unusually large values of capacity in its simple resonant circuit, and thus at 10 metres the tuning capacity is not reduced below 250 $\mu\mu$F.

A series of standard inductances (of from 5 to 100,000 μH), intended for use on sub-standard wavemeters and for other radio-frequency purposes, was exhibited. They are also due to Mr. Griffiths, and have for their underlying principle the temperature compensation which is obtained by constructing their formers of two different insulating materials; one of those materials, that which determines the diameter of the coil, has the same temperature coefficient of linear expansion as that of the copper winding itself; the other material on which the coil is wound, which must therefore be of low power factor, has a much higher temperature coefficient. A diagram was exhibited showing how the increase of inductance (with temperature rise), due to the expansion of the coil former, could be made to compensate exactly for the reduction due to the increase of pitch of winding.

The Lucas-Sullivan quartz-controlled standard wavemeter has been produced to meet the demand for a frequency meter of a more compact and cheaper form than the standard equipment. It consists of a specially cut and mounted crystal in vacuo, which simultaneously controls two harmonic-rich circuits of the Abraham-Bloch type. The l.f. side has a range of from 1 to 50 kc./sec., in steps of 1 kc./sec., and the h.f. side a range of 50 to 6,000 kc./sec., in steps of 50 kc./sec. The l.f.

side is also available for interpolation and the production of the characteristic partial harmonics. A range of controlled frequencies is thus available of 1 to 6,000 kc./sec., in steps of 1 kc./sec. Manufacturing conditions limit the possibility of the adjustment of the crystal to 1 part in 10^4 of a nominal value, but the final value can be given to 1 part in 2×10^5,

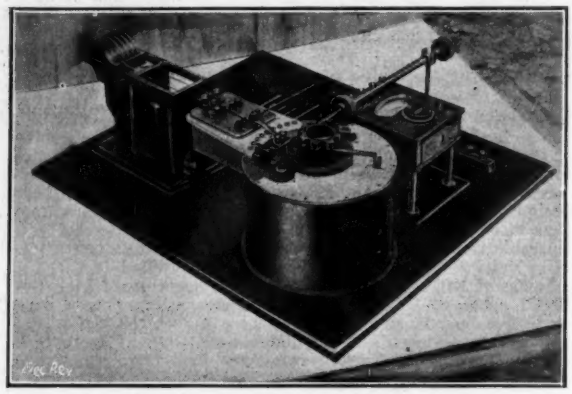


Fig. 2.—Precision Sub-standard Wavemeter, 5 to 100 m.

and the permanence of calibration is better than this figure. The overall accuracy is 1 part in 10^5, with a temperature coefficient of minus 3 parts in 10^6 per 1 deg. C.

Marconi's Wireless Telegraph Co., Ltd.

The company exhibited some recent productions of its research staff, including apparatus for ships, aircraft, broadcasting, and commercial wireless stations (fig. 3). Having regard to the interest now taken in aircraft, one of the most interesting exhibits was an aircraft direction finder with a special type of stream-lined frame aerial to enable airmen to find their bearings from stations on land or sea, and a short-wave receiver to enable them to receive telegraph and telephone signals. A wireless telephone set for use by persons having no technical qualifications was another interesting item, the use of this apparatus on trawlers, lighthouses, and lifeboats being borne in mind in the design. Other marine exhibits were a receiver with a wave range of from 15 to 20,000 metres and a new naval direction finder with a fixed aerial. An interesting piece of apparatus was a tuning fork with amplifying circuits used for keeping broadcasting stations exactly on their wavelength to prevent interference. A number of installations of this type have been supplied to the British Broadcasting Corporation to enable the relay stations to transmit on a common wavelength. A demonstration was given of the Marconi sounding device for ships; it sends high-frequency oscillations to the bottom of the sea, receives them back as an echo, and, by measuring the time which elapses between transmission and reception, indicates the depth of water under the ship.

A portable tone generator and valve voltmeter exhibited for the first time should be of value, not only to wireless workers, but also to the electrical industry generally. The tone generator delivers a pure sine wave of voltage over a frequency range variable between 20 and 10,000 cycles, the amplitude of the output remaining constant, and can be used for tests and measurements when a steady supply of pure tone frequency is essential. In its development as a testing instrument various applications suggested themselves, principally the testing of inter-valve low-frequency transformers, telephone earpieces and transformers, loud-speakers, and the modulation constancy of wireless telephone transmitters; it is also of use for measurements of capacity, inductance, and power factor. The tone generator contains two high-frequency oscillators, one operating at a fixed frequency and the other variable. The output from them is taken to a detector circuit, and the resultant beat, which is variable between 20 and 10,000 cycles, is amplified into a power output of 26 milliwatts; fine control of the output power to the circuit under test is provided. When used in conjunction with the Marconi valve voltmeter it forms a reliable means of measuring the gain of low-frequency amplifiers, the loss in low-frequency filters, and for testing the characteristic curves and measurement of attenuation of land lines and filters. There are, no doubt, many other uses for this equipment which will appeal to those requiring a constant supply of pure tones.

Crompton Parkinson, Ltd.

This company had on view a range of newly-designed ammeter and voltmeter movements, in the construction of which "Mumetal" irons are used. They are mounted in 6-in. and 8-in. switchboard-pattern cases, and in portable instrument cases. The pointers of all these instruments have a 120-deg. deflection, and practically even-scale divisions from one tenth up to the top of the scale. The indications are equally accurate on either d.c. or a.c. at frequencies of from 25 to 300, inclusive on one calibration.

A portable moving-coil "Universal Indicator," arranged for the direct attachment of shunts and resistances, was shown for the first time; readings from 50 micro-amperes up to 60 amperes and 250 micro-volts up to 600 volts can be taken. The instrument can be connected to any B.S.S. indicating, recording, or integrating instrument shunt, and is also convenient for use with American shunts having 50 m.v. drop. A special pattern is provided for educational purposes, having the movement exposed to view for demonstration purposes.

The new range of double-pivot indicating pointer galvanometers calibrated for direct readings in micro-volts and micro amperes exhibited were designed to withstand, without damage, momentary connection direct to a secondary cell. They are suitable for either bench use or wall mounting, and should largely replace the less sensitive patterns of suspension-type galvanometers. These instruments can be supplied with either damped or with undamped coils for ballistic work, and are as reliable and robust as standard moving-coil ammeters and voltmeters.

Baird & Tatlock (London), Ltd.

Amongst other things, this display included a signal-timing clock which, by the movement of a switch, can be set to operate a flash lamp; gong, single impulse; electric impulse at terminals for connection to time markers, &c.; a second switch enables the signals to be repeated at intervals of seconds as required.

The "Brook-Simcox" rapid evaporator is an electrically-heated air bath in which the heating elements are adjustable in height from top to bottom of the casing, which arrangement, combined with a three-heat switch, gives perfect control of conditions which hitherto have been entirely dependent on the adjustment of individual burners.

Electrometric titration apparatus designed by Mr. A. Hebden, Chelsea Polytechnic, consists of a special universal stand carrying a geared motor and stirrer, the latter being instantly adjustable for height without alteration of the driving belt. The titration vessel and necessary electrodes form a complete unit, and can be removed in a few seconds and replaced by the necessary electrodes and vessels for electro-analysis. The titration vessel can be removed for emptying and cleaning without disturbing the relative positions of the stirrer and various electrodes; at the same time these can be thoroughly washed, and the apparatus can then be re-assembled for the next titration; a very short time is required for the whole operation. For acid alkali titrations the quinhydrone or the hydrogen electrode may be used; when using the latter the liquid being titrated is completely protected from the air, which is swept out of the apparatus by the hydrogen gas.

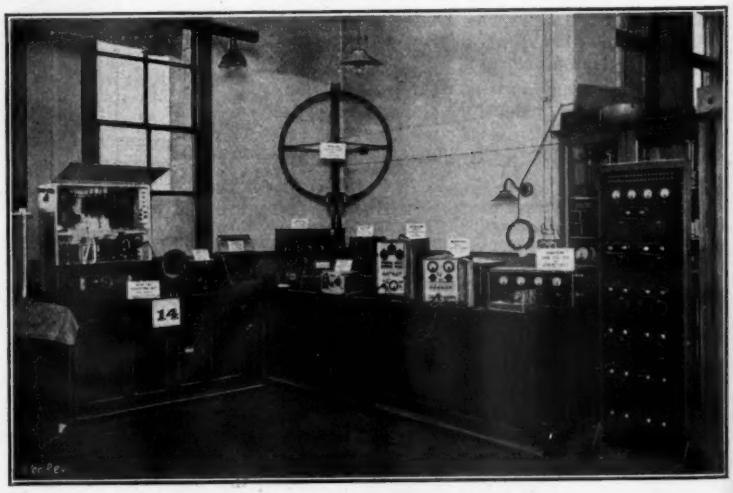


Fig. 3.—The Marconi W.T. Co.'s Exhibits.

The Electrical Association for Women.

The spring (London) fixtures of the Electrical Association for Women include the following: January 23rd, new year social; February 4th, lecture on "Plastic Lighting and Modern Architecture," by Mr. G. S. Francis; February 11th, E.A.W. play, "Watts in a Home"; February 28th, lecture on "Tariffs," by Mr. L. L. Robinson, M.I.E.E.; March 5th, social sub-committee "At Home"; March 12th, visit to Richmond House and Household Benefit Laundry, Ltd.; March 27th, visit to Ediswan Works, Ponders End; April 3rd, visit to Ideal Home Exhibition.

Women in the Electrical Industry.

Report on a Joint Meeting between the London Technical Group of the E.P.E.A. and the E.A.W.

A LECTURE was given last week by Miss C. Haslett (Director of the Electrical Association for Women) on the prospects for women in the electrical industry. Mr. P. RYCROFT (chairman of the London Technical Group) presided.

Miss Haslett said that the electrical industry offered women scope for employment in many directions. A few women had achieved distinction as electrical engineers; Mrs. Ayrton was the first woman to be elected a full member of the Institution of Electrical Engineers several years ago, and there were to-day a number of women in other grades of membership of the Institution, including such women as Miss Partridge, A.M.I.E.E., and Miss Entwistle, A.M.I.E.E. The difficulty of getting practical workshop or power station experience was still great, and the fact that women were prohibited by law from working after 8 p.m., was also an obstacle. The Electrical Association for Women and the Women's Engineering Association had discussed the latter with the Home Office and the International Labour Bureau at Geneva, and it was hoped in the next session of Parliament to be able to remove this obstacle. Trained women were now to be found in electrical works doing experimental work in connection with electric fires and similar apparatus, whilst other women were doing statistical and designing work.

A number of women were directors of small supply undertakings, one woman held the position of sales manager to a firm manufacturing electric tools, and many women were acting as secretaries and assistants to electrical engineers. Apart from Miss Norah Miller, who was publicity manager for the Ediswan Company, no woman held any responsible position in electrical publicity, although there should be scope here for women with a knowledge of electricity, coupled with artistic ability and advertising experience.

Every supply undertaking employing women should regard it as its duty to give them opportunities for becoming acquainted with the technical side of the business, so that they might answer consumers' queries.

The fact that more women had not taken to the technical side of the industry was largely owing to two reasons: (1) that engineering had not been considered, until recently, a suitable profession for women; and (2) that the general education of girls had not assisted them towards a technical or scientific career. This last-named inpediment had been discussed with the Board of Education, with the result that some attempt was to be made to give girls training in electrical matters whilst they were at school.

The domestic uses of electricity offered women the greatest scope, because all problems connected with domestic electrification were involved in problems related to household management and hygiene.

The Electrical Association for Women had, in collaboration with the Ministry of Labour, started classes for women at the Borough Polytechnic in electrical housecraft. In the matter of rural electrification also, there was great scope for women's activities, the Women's Institutes throughout the country were demanding lectures and information. There would seem here to be scope for women attached to the supply authorities who could go out to the villages, before work was put in hand, in order to discuss with those in the neighbourhood the reason why overhead lines were necessary and the way in which co-operation might be secured in obtaining wayleaves. Miss Partridge had been doing valuable work in rural districts, and had herself trained a number of apprentices who were capable of wiring houses and explaining intelligently to the country folk the mysteries of electricity. The use was advocated of electric caravans staffed by one or two women to travel about the country districts and make friends with the people, giving lectures and kinema and lantern slide displays.

There were now one or two women—engaged as electrical buyers in large retail shops—and it seemed that women who had a knowledge of the woman public could possibly buy to great advantage.

After a reference to the opportunities for women in public work connected with electricity, Miss Haslett emphasised the need of the electrical industry for the services of both men and women in all directions, and pleaded for freedom for all individuals, whether men or women, to do that work which their training and abilities most fitted them for.

Discussion.

Mr. JEFFERY doubted the ability of women to enter upon the constructional side of electrical engineering, owing to the fact that all the important higher positions required a great knowledge of mathematics, but admitted there were many opportunities for women in regard to domestic electrification, both in the towns and rural areas. Women should certainly be able to do an immense amount of work in regard to the design of apparatus used in the average small home, much of which seemed to be designed for homes where there was unlimited money.

Alderman Mrs. HAMMER (Hackney) claimed that the need for women in regard to domestic electrification was very urgent. Every home without electricity should be visited by a woman who could show the housewife what could be done by electricity. At the same time such women should be properly trained and properly paid.

Mr. W. J. OSWALD said that the idea of women's physical disability in regard to the workshop training necessary had to some extent disappeared with the entry of women into athletics, and also by reason of the shorter working day. Women could exercise a great influence upon the design of electrical apparatus for the home in that the really good saleswoman would get to know the difficulties of the users.

Councillor Mrs. GREGORY (West Ham) said that often a girl who was particularly fitted to take up a scholarship in engineering at a municipal technical college was not allowed to do so. Women could be born engineers. The chief aim of her life was to see all working women in all-electric homes.

Mr. DREW said that his firm made electrical instruments, and some of the work was so delicate that it could only be performed by women. Some of the women employés were very clever, but the firm could not get them to go beyond a certain point. If the E.A.W. could persuade girls to go in for some sort of technical training, his firm would be only too pleased to promote them to better positions.

Miss HASLETT replying, said the early up-bringing of women caused them to suffer from an "inferiority complex." The difficulty of women obtaining workshop experience was disappearing with the growing tendency to use more machinery. On the question of training, she mentioned that a course had been started that very evening at the Borough Polytechnic for women who were not engineers, but were secretaries to engineers, inspectors of factories, &c., or who held other positions where a knowledge of a technical side would help them towards promotion.

S.W. England and S. Wales Electricity Scheme.

An outline of a Scheme prepared by the Electricity Commission and transmitted to the Central Electricity Board.

THE South-West England and South Wales Electricity Scheme, prepared by the Electricity Commissioners in pursuance of Section 4 of the Electricity (Supply) Act, 1926, has been transmitted to the Central Electricity Board, and was published by the latter on January 15th.*

It is the seventh regional scheme†, and applies to an area of about 17,234 square miles, covering the whole of South Wales, the counties of Hereford, Monmouth, Somerset, Devon, Cornwall, Dorset, Wiltshire, and Southampton, parts of the counties of Berkshire, Gloucester, Oxford, and West Sussex, and the Isle of Wight. At the last census the area had a population of 6,085,500. The area embraces densely populated industrial centres, in which are situated important sea-ports, china-clay works, and coal and tin mines.

At present there are 165 authorised undertakers in the area owning between them 107 public generating stations. The consumption of electricity in 1927-28 was about 77 units per head of the above-mentioned population. It is estimated that this will increase to an average of 205 units in 1935-36.

Under the present proposals six existing stations and two new stations will be selected and operated for the Board. The existing selected stations will be extended by the addition of 3-phase, 50-cycle generating (and equivalent boiler) plant for operation by the winters of the years specified below:—

(i) Cardiff Corporation: 1-12,500 kW (1934-35).

(ii) Hayle (Cornwall Electric Power Co.): 3-12,500 kW (1931-32, 1936-37, 1942-43).

(iii) Newport Corporation: 1-25,000 kW (1936-37).

(iv) Portishead (Bristol Corporation): 3-50,000 (1937-38, 1939-40, 1942-43).

(v) Southampton Corporation: 2-18,750 kW (1934-35, 1935-36).

(vi) Upper Boat (South Wales Electrical Power Distribution Co.): 1-25,000 kW (1933-34).

The new selected stations will be:—

(i) Station "A" (on Southampton Water or other waterside site in south-east part of area) comprising an installation of 50,000 kilowatts of 3-phase, 50-cycle generating plant and equivalnt boiler plant (for operation by the winter of 1938-39), and an addition of 50,000 kilowatts of 3-phase, 50-cycle generating plant and equivalent boiler plant (for operation by the winter of 1941-42).

* Copies of the scheme, with map (1s. 6d. each) and of supplementary particulars (3s. 6d. each) are obtainable from H.M. Stationery Office.

† See ELEC. REV., January 25th and July 5th, 1929.

(ii) Station "B" (in South Wales) comprising an installation of 50,000 kilowatts of 3-phase, 50-cycle generating plant and equivalent boiler plant (for operation by the winter of 1940-41), and an addition of 50,000 kilowatts of 3-phase, 50-cycle generating plant and equivalent boiler plant (for operation by the winter of 1942-43).

Provision is also made for the following eleven stations to be worked under temporary arrangements for a few years:—Bath Corporation, Exeter Corporation, Feeder Road (Bristol Corporation), Llanelly (Llanelly and District Electric Supply Co., Ltd.), Lydney (West Gloucestershire Power Co., Ltd.), Moredon (Swindon Corporation), Newton Abbot (Torquay Corporation), Oxford (Oxford Electric Co., Ltd.), Plymouth Corporation, Portsmouth Corporation, and Swansea Corporation. It is also contemplated that a few of the remaining stations in outlying portions of the area will continue to be operated independently for the time being until it becomes economically practicable for the undertakers concerned to obtain supplies from the Board's system.

Broadly speaking, it is contemplated that two of the selected stations, namely, Portishead, belonging to the Bristol Corporation, and the Upper Boat station, belonging to the South Wales Electrical Power Distribution Company, will supply the base load, while the remainder will be used for meeting the peak load.

It is proposed that the stations shall be interconnected by a series of high-pressure transmission lines, designed in a series of ring mains, so that there will be alternative routes to points of supply and consequently greater security against breakdown. The main transmission system will comprise 622 route miles of 132-kV line and 25 transforming stations. The routes of the main transmission lines will be:—

(1) Reading to Portishead *via* or with connection to Oxford, Swindon and Melksham.
(2) Reading to Portishead *via* or with connection to Portsmouth, Southampton, Bourne Valley, Dorchester, Exeter and Taunton.
(3) Exeter to Hayle *via* or with connection to Newton Abbot, Plymouth and Fraddon.
(4) Portishead to Llanelly *via* or with connection to Cardiff, Upper Boat and Swansea.
(5) Llanelly to Worcester as far as the boundary of the area *via* or with connection to Maerdy, Upper Boat, Newport and Lydney.

The minimum aggregate transformer capacity at each of the principal main transforming stations has been provisionally determined as under:—

	kVA		kVA
Bourne Valley ...	40,000	Newton Abbot ...	20,000
Cardiff	30,000	Oxford	30,000
Dorchester	15,000	Plymouth	15,000
Exeter	30,000	Portishead	120,000
Fraddon	20,000	Portsmouth	20,000
Hayle	40,000	Southampton ...	40,000
Llanelly	20,000	Swansea	60,000
Lydney	60,000	Swindon	10,000
Maerdy	15,000	Taunton	40,000
Melksham	15,000	Upper Boat	90,000
Newport	60,000		

The secondary transmission at 33 kV or other approved voltage will involve a further 11 transforming stations. The routes of the secondary lines will be as follows:—

(1) Melksham to Bath; (2) Southampton to Salisbury; (3) Southampton to Andover, *via* or with connection to Winchester; (4) Taunton to Wellington; (5) Swansea to Neath; (6) Dorchester to Weymouth; (7) Taunton to Langport; (8) Taunton to Weston-super-Mare, *via* or with connection to Bridgwater; (9) Swansea to Swansea generating station; (10) Taunton to Taunton generating station; (11) Portsmouth to Portsmouth generating station.

The minimum aggregate transformer capacity at each of the secondary transforming stations has been provisionally determined as under:—

	kVA		kVA
Bath	20,000	Swansea	60,000
Bridgwater	7,000	Taunton	15,000
Littlehampton ...	2,000	Weston-super-Mare	6,000
Neath	3,000	Weymouth	8,000
Portsmouth	20,000	Winchester	4,000
Southampton ...	20,000		

Incidentally, the interconnection of these stations will result in the release for revenue-earning purposes of about 180,000 kW of plant now kept as spare and representing about £3,060,000 of capital. Completion of the scheme is expected by the autumn of 1933.

The scheme contemplates the standardisation of frequency of twenty undertakings, including the South Wales Electrical Power Distribution Company and the Cornwall Electric Power Company, at an estimated cost of £764,450.

The cost of the scheme to the Board for the erection of the transmission system is estimated at £4,163,484. In addition, there will be an expenditure by undertakers of about £1,934,360 on extensions of certain existing stations. It is estimated that the full advantages of the scheme can be secured with a saving of about £1,383,506 on capital expenditure (up to the year 1936-37) as compared with the capital expenditure that would be necessary if the present system were continued. After this date the saving on capital expenditure should be progressively greater as compared with individual development.

The Commissioners have outlined a provisional plan of working the stations with the necessary estimates. These suggestions are, of course, tentative, since the working of the scheme, including the fixing of tariffs, is the responsibility of the Board, but, taking the figures as they stand, it is of interest to note that the Commissioners estimate that in the five years 1932-1937 there will be a saving to the undertakers in the area of about £1,390,475—or an average of, roughly, £280,000 per annum.

Correspondence.

Correspondents should forward their communications as early as possible. No letter can be published unless we have the writer's name and address in our possession.

The Disadvantage of Prepayment Meters.

Undoubtedly many readers will have had experience of a temporary failure of lighting due to the installation of prepayment meters. It will be admitted that it is very annoying, whilst engaged in household duties, to have the electric current switched off without any warning whatsoever, and be stranded in total darkness while finding another coin to insert in the meter, which is generally fixed in "the cupboard under the stairs."

In the case of gas, one is forewarned by the dimming of the light, so that ample time is afforded te secure and insert the coin in the meter before failure.

Is there a prepayment meter on the market at the present time, in which is incorporated a warning device, functioning at a determined moment previous to the cutting off of the current?

If not, why not? Sudden extinction is certainly a drawback in many thousands of homes where the prepayment meter is employed.

N. W. Griffiths.

Newcastle-on-Tyne, *January 7th*, 1930.

Cleaning of Alabaster Globes.

If any of your readers have experience in the cleaning of alabaster globes, I shall be glad to hear what is considered to be the best method of dealing with the problem.

I understand that soap and water is liable to make the globes cloudy. At the same time it is very necessary to clean them when they get congested with dead flies, &c.

A method of cleaning without doing damage to the surface will be welcome.

C. Turnbull.

North Shields, *January 3rd*, 1930.

The All-electric House.

Mr. Moffett's comparison is of no value in determining the relative net cost of serving a house electrically and by other means. The comparison with Professor S. Parker Smith's house leaves out capital costs, and so renders Mr. Moffett's deductions not only valueless but actually misleading.

Also these two cases are particular, so that Mr. Moffett first offers an incorrect comparison of two particular cases, and then applies this valueless comparison to the general case.

If the case *against* the "All-electric House" rests on such argument, then it is pitiably weak.

My records show that the net cost of running the house electrically is less than by other means, and that the conveniences are cumulative.

Far from costing 87 per cent. more than other methods, a cost I could not tolerate, the net cost of working the house electrically is about 88 or 90 per cent. of that when using other methods, quite apart from such items as saving in decorations.

Mr. Moffett's chimney may show no smoke, yet it certainly emits poisonous fumes.

The ventilating effect of the coal fire is dragged in again, though I mentioned quite clearly that the chimneys in the house I occupy are not blocked, and that we get both adequate warmth and ventilation *without draughts*.

Whilst Mr. Moffett omits his capital costs, my accounts include hire of cooker and 3-pint kettle, which provides for repairs and replacements.

Even with the best lay out of gas cooker one can always

detect its presence before entering the kitchen; that is, one can detect the presence of burnt and partially burnt gas over and above the atmosphere essential to the cooking of food.

As an engineer, I am as anxious as Mr. Moffett to speed up the use of low-temperature carbonisation in conjunction with power generation, and/or the use of blast furnace and coke oven gas to aid electricity supply to remove the smoke and sulphur fumes nuisance and extract all the valuable by-products from our coal.

The more people use electricity, the greater will be the objection to our present methods of burning coal and generating electrical energy, and, as with the objections urged at Barton and Battersea, the large scale of working will emphasise the facts, bring public protest, and *force* some better method of working to be found.

Meanwhile, I reduce the work in my household, obtain better satisfaction and many otherwise unattainable conveniences, at a lower net cost, by using electricity purchased from the mains in place of coal, coalite, or gas heating and cooking. I also am doing something to reduce smoke emission.

W. T. Wardale, A.M.Inst.E.E.

Sheffield, *January 8th*, 1930.

The Design of Electric Cooking Apparatus.

I am very interested in your article on "Electric Cooker Design and Upkeep," and should like to state that I have found a method of cooking which eliminates a lot of work required of the hot plate, and effects considerable saving of time and energy.

I am using the "Pentacon," which is an enamelled steel vessel having an elliptical lid fitting on the inside of the vessel, and held up by a crossbar with an adjusting screw.

This apparatus is remarkably efficient, and is practically "cooking by high pressure steam." There is no loss of steam, and a spring loaded valve gives a whistling signal when the operation is concluded. The apparatus really requires marketing as a self-contained unit, and would, I feel sure, solve many troubles, as it cannot boil dry, also the time required for the various operations is only a quarter of that required in the ordinary way.

I have no interest in the sale of the apparatus, but here is an idea which surely needs developing.

E. A. Hall.

Grimsby, *January 15th*, 1930.

The Sale of Lamps by Municipalities.

Municipal trading is, of course, nothing new, and I suppose no amount of protest or complaint will alter it. Our local municipality has recently opened what, for the district, one might describe as somewhat palatial showrooms, and circularised everybody in the neighbourhood in an effort to get them to deal with them. When the quarterly bills are sent in the enclosed slips are attached to them, and we, the ratepayers, have to pay for all this magnificence and advertising which we cannot afford to do for ourselves.

Within five minutes walk of these particular showrooms there are at least nine electrical estabishments, most of which are paying rates to Salford, which is one of the highest rated towns in the country. So far as I personally am concerned, I think that I do not supply half a gross of lamps in Salford per annum, although at one time there was a flourishing business to be done in them.

W. O. Andrews.

Salford, *January 11th*, 1930.

[The slips referred to, advise consumers requiring electric lamps to ring up the Corporation's showrooms.—EDS. ELEC. REV.]

[Some correspondence has been held over due to pressure on our space.—EDS. ELEC. REV.]

Published Specifications.

Compiled expressly for this journal by a firm of Chartered Patent Agents. The numbers in parentheses are those under which the specifications will be printed and abridged and all subsequent proceedings taken.

1928.

17,390. "Magnetic suspension devices." S. Z. de Ferranti, and Ferranti, Ltd. June 15th, 1928. (292,995.)

17,391. "Electromagnets." S. Z. de Ferranti, and Ferranti. Ltd. June 15th, 1928. (292,996.)

17,636. "Alternating current supply systems." Ganz-Fele Villamossagi Reszvenytarsasag. June 28th, 1927. (Addition to 289,834.) (292,979.)

20,360. "Coil-winding machines and the like." C. J. Owen. and Automatic Coil Winder & Electrical Equipment Co., Ltd. July 12th, 1928. (Cognate application 5,158/29.) (322,999.)

20,556. "Apparatus for denoting and ascertaining the characteristics of ships, such as their position, type, manœuvres, or the like." Telefunken Ges. für Drahtlose Telegraphie. July 13th, 1927. (294,114.)

23,772. "Lamps and therapeutical buildings and structures for use in ultra-violet ray therapy." A. Rosenburg. August 17th, 1928. (Cognate application 16,274/29.) (323,032.)

23,966. "Artificial lines for telegraphy and like purposes." M. I. Pupin. February 24th, 1928. (306,521.)

25,733. "Sensitive electrical regulating, indicating, or recording devices." C. E. Foster and H. C. Oughton. September 7th, 1928. (323,022.)

26,139. "Electric junction boxes." S. O. Bowker. September 12th, 1928. (323,034.)

26,343. "Alternating-current bridge circuits." Standard Telephones and Cables, Ltd., and A. D. Blumlein. September 13th, 1928. (323,037.)

26,402. "Dielectric material for submarine cables." Standard Telephones and Cables, Ltd., and M. C Field. September 14th. 1928. (323,038.)

26,566. "Combined kinematograph and acoustic films and means for recording and reproducing." R. Cottnam. September 17th, 1928. (323,039.)

26,615. "Volume control for sound recording and reproducing." W. E. Beatty (Bell Telephone Laboratories, Inc.). September 17th, 1928. (323,014.)

26,617. "Sound recording and reproducing apparatus, particularly for advertising purposes." O. Bothe. September 17th, 1927. (297,327.)

26,622. "Generation of electric oscillations." Suddeutsche Telefonapparate-Kabel-und Drahtwerke Akt. Ges., and K. Kohl. September 17th, 1927. (297,328.)

26,718. "Sound-reproducing apparatus." Electramonic Co., Ltd., S. J. Tyrrell, L. N. Tyrrell and D. W. Sayers. September 18th, 1928. (323,016.)

26,727. "Telephone systems." Associated Telephone & Telegraph Co. September 21st, 1927. (297,427.)

26,729. "Incandescent electric lamps." B. B. Fenn. September 18th, 1928. (Cognate applications 29,461/28 and 34,789/28.) (323,017.)

26,741. "Electromagnetic compasses of the earth-inductor type." British Thomson-Houston Co., Ltd. September 22nd, 1927. (297,462.)

26,804. "Apparatus for producing electric current corresponding to light incident thereon." F. A. Lindemann. September 19th, 1928. (323,041.)

26,809. "Telephonic systems." A. Graham & Co., Ltd., W. J. Rickets and W. Stott. September 19th, 1928. (Cognate application 14,342/29.) (323,027.)

26,960. "Sound recording or reproducing devices." W. E. Beatty (Bell Telephone Laboratories, Inc.). September 20th, 1928. (323,043.)

27,007. "Apparatus for connecting instruments, meters, and the like to alternating-current systems carrying heavy currents." A. Egger. September 20th, 1928. (323,044.)

27,327. "Manufacture of loaded conductors." Electrical Research Products, Inc. September 24th, 1927. (Addition to 296,979.) (297,683.)

27,392. "Ovens and hoods of electric, gas, and oil cookers." L. Burns. September 24th, 1928. (323,049.)

28,133. "Thermionic valve amplifiers." Soc. des Ateliers de Montage et d'Ebenisterie. May 16th, 1928. (311,755.)

28,215. "Means or systems permitting of the transformation of a distribution at variable electric tension into a distribution at constant tension." A. Soulier. October 4th, 1927. (298,157.)

30,674. "High-tension switch-fuses." D. Danielsson and Allmänna Svenska Electriska Aktiebolaget. October 23rd, 1928. (323,071.)

31,605. "Insulating switches." J. B. Meiklejohn and J. B. Meiklejohn, Ltd. October 31st, 1928. (323,079.)

33,511. "Telephone systems." Burovox, Ltd., and J. K. Haynes. November 15th, 1928. (Cognate application 15,867/29.) (323,090.)

34,779. "Photographically recording sounds and pictures." De Forest Phonofilms, Ltd. December 3rd, 1927. (301,730.)

35,380. "Telegraph printers." F. Warburton. November 30th, 1928. (323,098.)

35,724. "Railway traffic-controlling apparatus." Westinghouse Brake and Saxby Signal Co., Ltd. December 8th, 1927. (301,914.)

36,295. "Electric driving arrangements." Luth & Rosens Elektriska Aktiebolag. March 1st, 1928. (307,008.)

37,476. "Mechanism for rotating the spindles of electric condensers or other instruments." Wilkins and Wright, Ltd., and J. H. Hewitt. December 19th, 1928. (323,108.)

37,539. "Means for retarding the action of electrical apparatus." J. W. Record and Record Electrical Co., Ltd. December 19th, 1928. (323,109.)

38,250. "Sound amplifiers." F. A. Mitchell. August 18th, 1928. (Divided application on 306,168.) (323,018.)

1929.

85. "Electric imitation fires." H. H. Berry. January 1st, 1929. (323,119.)

274. "Alternating-current load-transferring switches." A. W. G. Tucker and Ferranti, Ltd. January 3rd, 1929. (323,123.)

554. "Transformers." S. G. S. Dicker (Naamlooze Vennootschap Philips' Gloeilampenfabrieken). January 7th, 1929. (323,124.)

2,718. "Insulated electric lampholders." M. H. Goldstone. January 26th, 1929. (323,136.)

3,270. "Sparking-plugs for internal-combustion engines." B. Hopps and A. M. Lodge. January 31st, 1929. (323,143.)

3,450. "Quick-acting thermal electric switches." A. Daniker. February 6th, 1928. (305,538.)

4,851. "Apparatus for picture telegraphy." C. Lorenz Akt. Ges. February 15th, 1928. (306,091.)

4,866. "Aerials." Telefunken Ges für Drahtlose Telegraphie. March 3rd, 1928. (307,059.)

6,346. "Heat and sound insulating coverings." Rheinhold & Co., Vereinigte Kieselguhr-und Kerkstein Ges. May 29th, 1928. (Addition to 315,048.) (312,631.)

6,787. "Electric lampholders for vehicles." L. T. Dixon and W. J. Silvester. March 1st, 1929. (323,158.)

10,341. "Process for the manufacture of electrical condensers." International General Electric Co., Inc. April 4th, 1928. (309,079.)

10,840. "Electrostatic telephones." F. A. Schroeder. April 9th, 1929. (323,168.)

11,224. "Manufacture of electrically insulating materials." International General Electric Co., Inc. April 11th, 1928. (309,506.)

11,660. "Device for stopping electrically-drven looms by a weft-guard." K. Lenzkes. April 17th, 1928. (309,917.)

13,283. "Cathode-ray sterilisation." Siemens-Reiniger-Veifa Ges. für Medizinische Technik. April 30th, 1928. (310,806.)

23,012. "Reproduction of sound from sound-films." W. E. Beatty (Bell Telephone Laboratories. Inc.). September 12th, 1928. (Divided application on 321,148.) (323,008.)

31,807. "Recording or the reproduction of sound on or from sound-films." W. E. Beatty (Bell Telephone Laboratories, Inc.). September 12th. 1928. (Divided application on 321,148.) (323,046.)

Trade Mark Applications.

THE following are among the recent applications for British trade marks. Objections against any of the proposed marks may be entered within one month from January 8th:—

Bird and Coil (design only). No. 507,649. Class 5. Enamelled wire.—Die C. J. Vogel Draht & Kabelwerke Gesellschaft, Berlin. (British representatives: Boult, Wade & Tennant, 112, Hatton Garden, E.C.1.)

Stenophone, No. 507,502, and Radiopath, No. 507,625. Class 8. Philosophical and scientific instruments and apparatus for useful purposes.—James Robinson, 76, Millway, Mill Hill, N.W.7.

Pixie, No. 508,097. Class 8. Radio-telephonic apparatus and parts thereof, and radio-telephonic apparatus combined with gramophones.—Pero-Phone, Ltd., 76-78, City Road, E.C.2.

New Work for Contractors.

Particulars of new works and building schemes for the use of electrical installation contractors in search of work and all interested in the sale of electrical and allied plant and other products.

Publication in this list is no guarantee that electrical work is definitely included. Alleged inaccuracies should be reported to the Editors.

ANGMERING-ON-SEA (SUSSEX).—Re-erection of Willohayne Hotel, for A. Roper Spyers.

ASHTON-UNDER-LYNE.—Two schools for the Borough E.C.; director of education.

BARNSTAPLE.—Housing scheme (30), for the T.C.; borough surveyor.

BATH.—Workshops, stores, depôt, &c. (£23,000), for the T.C.; F. P. Sissons, city engineer.

BERRY WOOD.—Extensions to Mental Hospital (£90,000); Gotch & Saunders, architects to Northants C.C.

BIRKENHEAD.—Central school, Tollemache Road, and extensions, Temple Road Central School, for the E.C.

BIRMINGHAM.—Houses on various estates; W. J. Simms, Sons and Cooke, Ltd. (1,200), Housing, Ltd. (400), C. Hougham (18), Morris, Jacombs & Sons, Ltd. (127). Shops on housing estates (£51,000); city engineer. Waterworks, Elan (£300,000); water engineer.

BRADFORD.—Building for mentally defectives at Westwood, Clayton, for Bradford Mental Deficiency Committee (£105,000); city architect, Town Hall.

CHEADLE AND GATLEY.—School (800 places), for Cheshire E.C.; R. Potts, clerk, Chester.

CHELMSFORD.—Completion of county office extension scheme; Essex county architect.

CHESTERFIELD.—Alterations and extensions to the sewage works, Whittington; borough engineer.

COVENTRY.—Arcade, Smithford Street (£38,500); city engineer.

CROYDON.—Whitgift Grammar School (£113,300), for the governors; Leathart & Granger, architects, Adelphi, London; E. H. Smith, builder.

DONCASTER.—Central school (960 places), for the Borough E.C.; director of education.

DOUGLAS (I.O.M.).—Reconstruction of tram depôt; tramway manager.

DUDLEY.—Six schools for the Borough E.C.; director of education.

DUMBARTONSHIRE.—School at Clydebank, for Dumbartonshire Education Authority; the clerk, Education Authority, Dumbarton.

DUNDEE.—School (900 places); clerk, Education Authority.

DUNMOW.—Additional 48 houses for the R.D.C.; surveyor.

EAST MALLING (MAIDSTONE).—Factory extensions, New Hythe Lane, for the Colthrop Board & Paper Mills, Co.

GLASGOW.—Houses and flats (318), Calton area; housing director. Library, Gorbals district (£23,000); city architect. Maternity hospital, Shieldhall Road; city engineer.

GRANTHAM.—Garage, workshops and offices, for the Lincs. Road Car Co., Ltd.; A. E. Brown & Co., builders.

HASTINGS.—Extensions to Hollington schools, with heating and lighting (£4,000), for the Borough E.C.; borough engineer.

HOLLINWOOD.—R.C. Church; parish priest, Corpus Christi R.C. Church.

LEICESTER.—Pavilion, Abbey Grounds (£13,599); F. Elliott. Civic aerodrome, Braunstone; city engineer.

LONDON (LEYTON, E.).—Schools and extensions (£59,963), for the Borough E.C.; director of education.
(WEST HAM, E.).—Extensions, Harold Wood Hospital, for the T.C.; borough engineer (returnable deposit of £1).

LUTON.—Factory and office extensions, for the Skefko Ball Bearing Co., Ltd.; Manning and Steele, architects, 5, George Street West.

MACCLESFIELD.—Additional 252 houses for the T.C.; C. Hamson, borough surveyor.

MAIDSTONE.—Development of The Walk Meadows, Mote Park, as residential estate, for William Webb, High Street, Chatham. Offices, Tonbridge Road, for T.C.; borough surveyor, Palace Avenue, Maidstone (returnable deposit of £2 2s.).

MANCHESTER.—Houses (638), West Didsbury estate; elementary school, Mauldeth Road, Withington (21,500); refuse plant, Mount Road depôt; city architect.

MARKET HARBOROUGH.—Houses (50); U.D.C. surveyor.

MIDDLETON (LANCS.).—Four schools for the Borough E.C.; director of education.

NEWCASTLE-ON-TYNE.—Four schools; director of education, City Education Offices.

NORTHAMPTON.—Technical college workshops (£68,750), and racecourse pavilion (£6,000), for the T.C.; sewage works (£105,000); borough engineer. Extensions, Cinema, Alcombe Road; Mr. Norfolk. Extensions, boot factory, Barry Road; J. Sears & Co., Ltd.

PLYMOUTH.—Three shops and eight houses, Peverell Park Road; Tozer Bros. Nurses' home, observation and diptheria blocks, &c., at the Swilly Hospital, for the Corporation. Water scheme, Cattedown (£175,000); water engineer. Garage, Laira Bridge Road; Western National 'Bus Co., Ltd.

RETFORD.—Additional housing scheme (128), for the T.C., borough surveyor.

RICKMANSWORTH.—Conversion of Basing House into municipal offices, with electrical work for heating and lighting, for the U.D.C.; A. Freeman, surveyor.

ROTHERHAM.—Housing scheme (440), for the T.C.; V. Turner, borough engineer (returnable deposit of £2 2s.).

SALFORD.—Re-housing scheme (4 acres), at Lower Broughton; borough engineer.

SEAHAM HARBOUR.—Additional housing scheme (192), for the U.D.C.; surveyor.

SHEFFIELD.—Houses (165), Langley estate; re-housing for 782 families, Spring Street area; city architect.

SHOREHAM (SUSSEX).—Re-erection of works, Brighton Road, for Messrs. Hankinsons.

SOUTHAMPTON.—New Deanery school (£43,954), for the Borough E.C.; T. Conway, Ltd., builders, Weymouth.

STAFFORDSHIRE.—Schools and extensions (£747,800), for Staffs. E.C.; director of education, Stafford.

STEVENAGE.—Houses (58), for the U.D.C.; Robert Field, builder.

STOCKPORT.—Four senior and two junior schools (£177,160), for the Borough E.C.; A. Lawton, secretary.

STOKE-ON-TRENT.—Schools at Fenton, Longton, Burslem, Hanley, and Northwood; director of education.

STOURBRIDGE.—Additional 180 houses, High Park estate, for the T.C.; borough surveyor.

STRATFORD.—Rebuilding police court; Essex Standing Joint Committee.

STRETFORD.—Houses (130), Barton and Melville Roads; J. W. Maunders. Alterations, Lyceum Theatre; W. Stansfield.

TIPTON.—Additional 86 houses for the U.D.C.; H. N. Woodard, surveyor.

TORQUAY.—Houses (43), Barton Road; executors of G. E. Tozer. Development, Furzewell estate, St. Marychurch Road; S. Vanscolina.

TWICKENHAM.—Housing scheme (84) and depôt (£6,950), for the T.C.; borough engineer.

UXBRIDGE.—Houses (58) on the Cowley Hall estate, for Uxbridge U.D.C.; W. L. Eves, architect.

WELWYN.—Public hall and offices (£12,000), for the R.D.C.; surveyor.

WIGAN.—School, Gidlow (£41,257), for the Borough E.C.; director of education.

WINCHESTER.—Showroom and offices, Twyford, for the T.C.; Cancellor & Sawyer, architects, Queen Anne Chambers (returnable deposit of £2 2s.).

WOLVERHAMPTON.—Technical college (£158,000); Col. Lowbridge and Fleeming & Son, architects.

YORK.—'Bus garage, with workshops, &c. (£19,000), for the T.C.; borough engineer.